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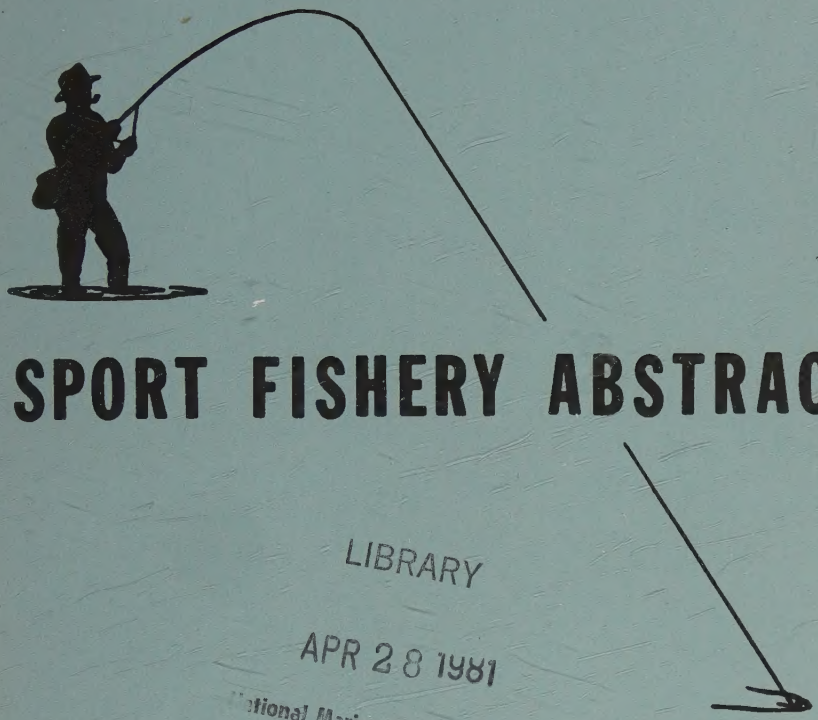

SPORT FISHERY ABSTRACTS

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SPORT FISHERY ABSTRACTS

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Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

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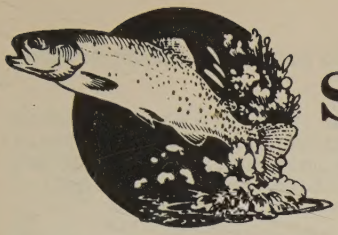

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 26 Number 1 1981

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AQUATIC PLANTS AND THEIR CONTROL

81-000001 Davis, G. J. and M. M. Brinson. RESPONSES OF SUBMERSED VASCULAR PLANT COMMUNITIES TO ENVIRONMENTAL CHANGE: SUMMARY. *U.S. Fish Wildl. Serv.* FWS/OBS-80/42. iii + 16p. Aug. 1980. SFA 26(1)
[Dep. Biol., East Carolina Univ., Greenville, NC 27834]

81-000002 Haller, W. T.; J. V. Shireman and D. F. DuRant. FISH HARVEST RESULTING FROM MECHANICAL CONTROL OF HYDRILLA. *Trans. Am. Fish. Soc.* 109(5):517-520. Sept. 1980. SFA 26(1)
[Aquatic Plants Res. Cent., Sch. For. Resour. Conserv., Univ. Fla., Gainsville 32611]

81-000003 Hellquist, C. B. and G. E. Crow. AQUATIC VASCULAR PLANTS OF NEW ENGLAND: PART 1. ZOSTERACEAE, POTAMOGETONACEAE, ZANNICHELLIACEAE, NAJADACEAE. *Univ. N.H. Agric. Exp. Stn. Bull.* 515. iii + 68p. Jan. 1980. SFA 26(1)
[Dep. Biol., Boston State Coll., 625 Huntington Ave., Boston, MA 02115]

GENERAL FISH CULTURE

81-000004 Edwards. P. A REVIEW OF RECYCLING ORGANIC WASTES INTO FISH, WITH EMPHASIS ON THE TROPICS. *Aquaculture* 21(3):261-279. Nov. 1980. SFA 26(1)
[Div. Agric. Food Eng., Asian Inst. Technol., Bangkok, Thailand] The world ecosystem is becoming increasingly more unstable through reliance on finite resources of oil. Alternative strategies of development for food production are required since modern methods of terrestrial agriculture and fisheries are energy intensive. A significant effect could be made through recycling organic wastes, animal, agro-industrial and human, into fish. Organic wastes can be recycled in ecologically sound pond or lagoon systems fueled by solar energy. The reuse of wastes would safeguard the environment from pollution and lead to a reduction in diseases of insanitation. The extent of waste recycling in Asia is described and its potential for tropical, developing countries is emphasized.

81-000005 FAO of the UN. REPORT OF THE *AD HOC* CONSULTATION ON AQUACULTURE RESEARCH. *FAO Fish. Rep.* No. 238. vi + 26p. May 1980. SFA 26(1)
[Rome, Italy]

81-000006 Helfrich, L. A.; D. L. Weigmann and D. L. Garling, Jr. COMMERCIAL AQUACULTURE IN VIRGINIA IN 1978. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:318-323. 1979(1980). SFA 26(1)
[Dep. Fish. Wildl. Sci., VIP&SU, Blacksburg, VA 24601] In 1978, all commercial aquaculture enterprises operating in the state were surveyed by telephone and in person to determine the status of the industry and to assess

GENERAL FISH CULTURE (CONTINUED)

81-000006 CONTINUED the biological and economic feasibility of rearing aquatic organisms for profit in Virginia. A total of 11 commercial aquaculture firms were in business during 1978. Six establishments were producing rainbow trout (*Salmo gairdneri*) for food and stocking recreational waters, 2 were rearing warmwater sport fish fingerlings and bait fish, and 3 were culturing clams. In contrast to most southern states, no commercial producers in Virginia were growing edible-size channel catfish (*Ictalurus punctatus*) for food. The gross economic return from freshwater fish production in Virginia during 1978 was conservatively estimated to exceed $1,000,000 at the first level. Rainbow trout accounted for 75% of the total income. Production of warmwater fingerling sport fish was the second leading source of income, representing about 24% of the total economic returns. Income from bait minnow production contributed less than 1% of the total value.

TROUT AND SALMON CULTURE

81-000007 Billard, R. PROLONGATION DE LA DURÉE DE MOTILITÉ ET DU POUVOIR FÉCONDANT DES SPERMATOZOÏDES DE TRUITE AR-EN-CIEL PAR ADDITION DE THÉOPHYLLINE AU MILIEU DE DILUTION. [PROLONGATION OF MOTILITY AND FERTILIZING ABILITY OF RAINBOW TROUT SPERMATOZOA AFTER THE ADDITION OF THEOPHYLLINE TO THE DILUTER.] *C. R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 291(7):649-652. 20 Oct. 1980. In French with English summ. SFA 26(1)
[Lab. Physiol. Poissons, I.N.R.A., 78350 Jouy-en-Josas, France] After rainbow Trout sperm were diluted in 0.01 and 0.001 M theophylline media, motility and fertilizing ability were prolonged as compared to the control media without theophylline. However, the motility observed was lower and of a different type than normal motility. This suggests that other factors besides cyclic nucleotides intervene in the motility of Trout spermatozoa.

81-000008 Davis, D. and D. J. Behmer. HATCHING SUCCESS OF LAKE WHITEFISH EGGS IN HEATED WATER. *Prog. Fish-Cult.* 42(4):215-217. Oct. 1980. SFA 26(1)
[Biol. Dep., Lake Superior State Coll., Sault St. Marie, MI 49783]

81-000009 Nagahama, Y.; H. Kagawa and F. Tashiro. [THE *IN VITRO* EFFECTS OF VARIOUS GONADOTROPINS AND STEROID HORMONES ON OOCYTE MATURATION IN AMAGO SALMON *ONCORHYNCHUS RHODURUS* AND RAINBOW TROUT *SALMO GAIRDNERI.*] *Bull. Jpn. Soc. Sci. Fish.* 46(9):1097-1102. Sept. 1980. In Japanese with English summ. SFA 26(1)
[Natl. Inst. Basic Biol., Okazaki 444, Japan]

OTHER ANADROMOUS SPECIES CULTURE

81-000010 Parker, N. C. STRIPED BASS CULTURE IN CONTINUOUSLY AERATED PONDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:353-360. 1979(1980). SFA 26(1)
[U.S. FWS, Southeast. Fish Cult. Lab., Marion, AL 36756] Production of striped bass (*Morone saxatilis*) fingerlings in eight 0.02-ha ponds aerated with continously operated airlift pumps averaged 181,000 fish/ha. Ponds were initially fertilized with hay at either 560, 1120, or 2240 kg/ha and zooplankton blooms were maintained with hay and meat scrap fertilizers. The average daily application of organic fertilizers ranged from 32 to 82 kg/ha. Five-day-old fry were stocked at the rate of 250,000, 500,000, or 1 million/ha. Fry were supplementally fed at 45% protein diet 3 times per day after they were 22 days old. After 44 days in the pond the average weight and

OTHER ANADROMOUS SPECIES CULTURE (CONTINUED)

81-000010 CONTINUED total length of the 49-day-old fingerlings were 0.5 g and 3.0 cm. Return per treatment averaged 116, 29, and 22% for the low, medium, and high stocking densities, respectively, and daily production averaged 2.1, 1.2, and 2.6 kg/ha. The airlift pumps maintained dissolved oxygen above 3 mg/1 when organic input averaged 62 kg/ha per day or less. The average number of fingerlings produced per hectare was 2.4 times greater than that commonly achieved in conventional pond culture.

WARMWATER CULTURE

81-000011 Bidgood, B. F. PROCURING AND TRANSPORTING WALLEYE EGGS FROM REMOTE LOCATIONS TO A CENTRALIZED HATCHERY. *Alberta Dep. Energy Nat. Resour. Fish. Res. Rep.* No. 19. Mar. 1980. SFA 26(1)

Various techniques of capturing and spawning walleye and hardening and transporting walleye eggs from an isolated location to a hatchery were tested and compared. Walleye eggs when hardened for 24 hours to 5 days in floating egg trays located near the mouth of the river and treated daily with a surface sterilent had low mortalities. Hardened walleye eggs were successfully transported in cushioned, insulated egg trays by a boat, all-terrain vehicle, wheeled aircraft, and truck to the hatchery for incubation.

81-000012 Billard, R. and J. Marcel. STIMULATION OF SPERMIATION AND INDUCTION OF OVULATION IN PIKE *(ESOX LUCIUS). Aquaculture* 21(2):181-195. Oct. 1980. SFA 26(1)

[Lab. Physiol. Poissons, I.N.R.A., 78350 Jouy-en-Josas, France] Mature northern pike were given various hormonal treatments in March or April in order to stimulate spermiation or to induce ovulation. In males the total amount of sperm collected after treatment increased, in comparison with saline-injected males, by 3-11 times with partially purified salmon gonadotropin (PPSG-activity: half of the highly purified s-GTH; injected at doses of between 5 and 100 µg/kg body weight); 3-6 times with crude carp pituitary extract (0.5-3 mg/kg body weight); and 3-7 times with fresh pike pituitaries (14 and 1.2 mg wet weight/kg body weight). The sperm obtained after hormonal treatment was of good quality. Intracardiac injection of superactive LRH analogue had no effect. In females, PPSG induced 90 and 100% ovulation at the doses of 50 and 25 µg/kg body weight. Dried salmon pituitaries (2.5 mg/kg, equivalent to 50 µg of PPSG) gave 25% ovulation; at 10 mg/kg, 25% complete ovulation was again recorded, but in addition 70% of the females showed oocyte maturation and partial ovulation. Similarly, dried carp pituitary (3 mg/kg) induced only oocyte maturation but no ovulation. The oocytes obtained after hormonal treatment were in general fertile. Intraperitoneal injection of LRH in an emulsified form induced neither oocyte maturation nor ovulation. The lack of effect of LRH analogue is discussed and shows that the use of this compound as a substitue for pituitary preparation is not very promising.

81-000013 Boyd, C. E.; J. A. Steeby and E. W. McCoy. FREQUENCY OF LOW DISSOLVED OXYGEN CONCENTRATIONS IN PONDS FOR COMMERCIAL CULTURE OF CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:591-599. 1979(1980). SFA 26(1)

[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

81-000014 Central Luzon State University Freshwater Aquacultre Center. PROGRESS REPORT OF THE FRESHWATER AQUACULTURE CENTER. *Cent. Luzon State Univ. Freshwater Aquacult. Cent. Tech. Rep.* No. 16. v + 104p. 1980. SFA

WARMWATER CULTURE (CONTINUED)

81-000014 CONTINUED 26(1)
[Freshwater Aquacult. Cent., Cent. Luzon State UNiv., Muñoz, Nueva Ecija 2320, Philippines]

81-000015 Duffield, D. J. CAGE CULTURE OF CHANNEL CATFISH, *ICTALURUS PUNCTATUS* (RAFINESQUE), IN A TERTIARY WASTEWATER TREATMENT POND AND A PRIVATE POND IN SOUTHERN MICHIGAN. *M.S. thesis, Mich. State Univ.* 51p. 1979. From Masters Abstr. 18(4):257. Dec. 1980. SFA 26(1)
Channel catfish were reared in 0.8 m^3 cages in a southern Michigan farm pond and a pond which received secondary treated domestic waste water. Cages were stocked in May with 117 mm fingerlings at densities of 50, 100 and 150 fish per cubic meter. The fish production in the farm pond was approximately 44.8 kg/m^3 in the wastewater pond. The lower production in the wastewater pond was probably due to adverse water quality conditions including high pH, low dissolved oxygen and high concentrations of un-ionized ammonia. Total mortality of the fish in the wastewater pond occurred in September when dissolved oxygen levels declined to less than 1.0 mg/l. Fish production was not significantly affected by different stocking densities. The results indicate that cage culture is not suitable in highly enriched wastewater ponds with extensive plant growth but successful cage culture may be practiced in southern Michigan farm ponds.

81-000016 Hearn, M. C. OVULATION OF POND-REARED WALLEYS IN RESPONSE TO VARIOUS INJECTION LEVELS OF HUMAN CHORIONIC GONADOTROPIN. *Prog. Fish-Cult.* 42(4):228-230. Oct. 1980. SFA 26(1)
[Ky. Dep. Fish Wildl., Minor E. Clark Hatchery, Morehead 40351]

81-000017 Henderson, S. PRODUCTION POTENTIAL OF CATFISH GROW-OUT PONDS SUPPLEMENTALLY STOCKED WITH SILVER AND BIGHEAD CARP. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:584-590. 1979(1980). SFA 26(1)
[Ark. Game Fish Comm., 2 Natural Resources Dr., Little Rock 72205] Three experimental ponds were stocked with a polyculture of channel catfish (*Ictalurus punctatus*), silver carp (*Hypophthalmichthys molitrix*), and bighead carp (*Aristichthys nobilis*). Three control ponds were stocked with catfish alone. In 2 of the 3 sets of ponds, there was little difference in catfish production (less than 1 and 10% by weight) while total production in the polyculture ponds far exceeded the controls with catfish alone. In the remaining set, catfish production was less in the polyculture pond but total production remained higher as a result of the additional growth of the silver and bighead carp. Lesser objectives were to refine artificial spawning methods and describe the difference in water quality resulting from the presence of the filter feeding Chinese carps. Successful hormone induced spawning techniques were developed and an improvement in pond water quality was noted.

81-000018 Kumar, S. and K. Chandrasekhar. ARTIFICIAL SPAWNING EFFECTED IN THE FRESH WATER TELEOST, *CYPRINUS CARPIO* BY CLOMIPHENE CITRATE. *Experientia (Basel)* 36(10):1229-1230. 15 Oct. 1980. SFA 26(1)
[Surg. Res. Lab., Inst. Med. Sci., Banaras Hindu Univ., Varanasi-5, India] Triweekly i.m. injections of clomiphene citrate (group I, 25 µg/0.5 ml and group II, 50 µg/1.0 ml) were administered for a period of 3 months during the preparatory period to female fresh water teleosts exhibiting ovarian recrudescence, while a control group received 0.5 ml of physiological saline throughout the period of experimentation i.e., from February through April. 50 µg clomiphene citrate treatment brought about a steady increase in ovarian size, and oocytes began to enlarge and mature and finally ovulation took place in April. This is 4 months ahead of their normal occurence.

WARMWATER CULTURE (CONTINUED)

81-000019 Lam, T. J. THYROXINE ENHANCES LARVAL DEVELOPMENT AND SURVIVAL IN *SAROTHERODON (TILAPIA) MOSSAMBICUS* RUPPELL. *Aquaculture* 21(3):287-291. Nov. 1980. SFA 26(1)

[Dep. Zool., Univ. Singapore, Bukit Timah Rd., Singapore] Yolk-sac larvae were obtained from the mouth of brooding female tilapia (*Sarotherodon mossambicus* Ruppell). Treatment of these larvae with L-thyroxine-sodium (Eltroxin, Glaxo) by immersion in 0.1 ppm solution (changed daily) markedly accelerated their development and enhanced their survival. This effect of thyroxine, if confirmed in other species, may find applications in the improvement of larval rearing.

81-000020 Masui, Y. and E. E. Brown. CURRENT PRODUCTION AND MARKETING PROBLEMS OF JAPANESE EEL. *Riv. It. Piscic. Ittiop.* 15(3):67-80. July-Aug.-Sept. 1980. In English and Italian. SFA 26(1)

[Dep. Agric. Econ., Tokyo Univ., Tokyo, Japan]

81-000021 Pierce, B. A. PRODUCTION OF HYBRID *TILAPIA* IN INDOOR AQUARIA. *Prog. Fish-Cult.* 42(4):233-234. Oct. 1980. SFA 26(1)

[Univ. Hawaii Manoa, Dep. Oceanogr., 2525 Correa Rd., Honolulu 96822]

81-000022 Rakocy, J. E. EVALUATION OF A CLOSED RECIRCULATING SYSTEM FOR TILAPIA CULTURE. *Ph.D. dissertation, Auburn Univ.* 129p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(6):1994. Dec. 1980. SFA 26(1)

81-000023 Ramos-Henao, A. and G. G. Corredor. EFFECTS OF THREE MANAGEMENT PRACTICES ON THE GROWTH AND PRODUCTION OF *TILAPIA RENDALLI*. *Bamidgeh* 32(2):41-45. June 1980. SFA 26(1)

[Secc. Piscicult., Univ. Caldas, Manizales, Colombia] *Tilapia rendalli* (Boulenger, 1896) introduced into Colombia in 1967 is now being cultured in small ponds under climatological conditions quite different than in nature. Extended projects with this species have been based on the results of field trials carried out at the Fish Culture Experimental Center, University of Caldas (altitude-1,015 m, average air temperature - 24°C). The projects have been aimed at improving the nutritional state of poor peasant families. Farmers are taught to fertilize ponds with mainly pig, chicken or cattle manure, and to feed the fish a wide variety of green plants, especially the fresh leaves of *Alocasia macrorhiza (Araceae)*. Most ponds are quite small -- total area of less than 200 m^2. The owner and his family are supposed to practice fishing so intensively as to adequately control population abundance. In larger units however, it is also necessary to stock the predator *Cichla ocellaris* in order to police proliferation of the Tilapia. It is important to be able to quantify individual fish growth, carrying capacity and yield with the effects of organic fertilization with pig manure, the control of the Tilapia's wild spawning by *C. ocellaris* and supplemental feeding with *A. macrorhiza*. A consecutive series of field trials was run in one pond. The objective of this experimental design, was to avoid the widely variable results for the different ponds commonly obtained at this Centre. The assumption underlying this design is that annual changes in climatic conditions have a less important effect on fish growth and yield than the prevailing ill-defined abiotic factors.

81-000024 Rothbard, S. and G. Hulata. CLOSED-SYSTEM INCUBATOR FOR CICHLID EGGS. *Prog. Fish-Cult.* 42(4):203-204. Oct. 1980. SFA 26(1)

[Aqua. Res. Organ., Fish Aquacult. Res. Stn., Dor, D.N. Hof Hacarmel, Israel]

81-000025 Sarig, S. and Y. Arieli. GROWTH CAPACITY OF TILAPIA IN INTENSIVE CULTURE. *Bamidgeh* 32(3):57-65. Sept. 1980. SFA 26(1)

[Lab. Res. Fish Dis., Nir David, 19150 Israel]

WARMWATER CULTURE (CONTINUED)

81-000026 Stephens, W. W. and J. K. Beadles. EFFECTS OF CROPPING ON GROWTH OF CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:572-583. 1979(1980). SFA 26(1)

[Box 166, Belzoni, MS 39038] From 20 May to 28 October 1978, 5 experimental fish ponds at Arkansas State University Fish Farm, Walcott, Arkansas, were utilized in determining the effects of cropping on channel catfish growth. Three ponds were used as experimental ponds and 2 as controls. Selected physiocochemical properties of the water were measured. With the exception of air and water temperatures, properties of the experimental ponds fluctuated more than the controls due to indirect effects of cropping. However, all values fell within acceptable ranges for channel catfish (*Ictalurus punctatus* Rafinesque) culture. Mean biweekly gains for the experimental and control fish were .065 and 0.63 kg respectively. Analysis of variance and t-test analysis indicated that at an innitial stocking density of 3720 fish per ha, cropping yielded no significant differences in growth rate or weight gain.

81-000027 Tomasso, J. R.; B. A. Simco and K. B. Davis. INHIBITION OF AMMONIA AND NITRITE TOXICITY OF CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:600-605. 1979(1980). SFA 26(1)

[Ecol. Res. Cent., Dep. Biol. Memphis State Univ., Memphis, TN 38152] Ammonia is the primary nitrogen-containing waste product of fish. Under natural conditions, ammonia is converted first to nitrite and then to nitrate. Ammonia and nitrite are toxic to fish at low levels, but nitrate is relatively non-toxic. Ammonia has a variety of toxic effects, including reduced growth rates, whereas nitrite primarily interferes with oxygen transport. The literature pertaining to toxic levels and effects of environmental ammonia and nitrite as well as experimental methods of inhibiting these toxicities are reviewed. Prevention of elevated pH for high ammonia conditions, and the addition of sodium chloride for elevated nitrite levels are suggested as possible inhibitors of these toxicities in channel catfish production.

81-000028 Willis, D. W. and S. A. Flickinger. SURVEY OF PRIVATE AND GOVERNMENT HATCHERY SUCCESS IN RAISING LARGEMOUTH BASS. *Prog. Fish-Cult.* 42(4):232-233. Oct. 1980. SFA 26(1)

[Dep. Biol., Pittsburg State Univ., Pittsburg, KS 66762]

81-000029 Zur, O. THE IMPORTANCE OF CHIRONOMID LARVAE AS NATURAL FEED AND AS A BIOLOGICAL INDICATOR OF SOIL CONDITION IN PONDS CONTAINING COMMON CARP (*CYPRINUS CARPIO*) AND TILAPIA (*SAROTHERODON AUREUS*). *Bamidgeh* 32(3):66-77. Sept. 1980. SFA 26(1)

[Minist. Agric., Fish. Dep., Tiberias, P.O.B. 33, Israel] Determinations were made of the rate of disappearance of Chironomid larvae from the bottom of fish ponds. Samples were taken from pond areas impermeable to fish. It was found that the higher the fish density, the greater the rate of disappearance of the larvae. In semi-intensive and intensive ponds (7000-100,000 fish/ha) no chironomid larvae were present 1-5 weeks after stocking. Their disappearance can be attributed to unfavorable, anaerobic conditions due to gradual accumulation of organic matter on the pond bottom. This process probably also brings about the inhibition of fish growth.

MARICULTURE

81-000030 Bower, C. E. and T. Holm-Hansen. A SIMPLIFIED HYDRAZINE-REDUCTION METHOD FOR DETERMINING HIGH CONCENTRATIONS OF NITRATE IN RECIRCULATED SEAWATER. *Aquaculture* 21(3):281-286. Nov. 1980. SFA 26(1)

MARICULTURE (CONTINUED)

81-000030 CONTINUED
[Sea Res. Found., Inst. Aquarium Stud., P.O. Box 7-495, West Hartford, CT 06107]

81-000031 Chervinski, J. and J. Shapiro. ADDITIONAL EXPERIMENTS ON THE GROWTH OF JUVENILES AND FINGERLINGS OF THE EUROPEAN SEA BASS (*DICENTRARCHUS LABRAX* L.). *Bamidgeh* 32(3):78-86. Sept. 1980. SFA 26(1)
[Fish Aquacult. Res. Stn., Dor, Israel] Laboratory experiments were conducted with juvenile *Dicentrarchus labrax* L. in order to determine their ability to grow and develop in fresh water on small zooplankton and zoobenthos. Fish of 0.036g. weight were able to grow on small Cladocera and Copepods. Juveniles of 25-29mm total length were able to feed on fry of *Sarotherodon* sp. *D. labrax* of 0.77g weight, fed *Sarotherodon* sp. showed an individual growth rate of 0.06-0.11 g/day and a food conversion rate of 8.18 when raised to the size of 3.57g.

81-000032 Hirose, K. EFFECTS OF REPEATED INJECTIONS OF HUMAN CHORIONIC GONADOTROPIN (HCG) ON OVULATION AND EGG QUALITIES IN THE AYU, *PLECOGLOSSUS ALTIVELIS*. *Bull. Jpn. Soc. Sci. Fish.* 46(7):813-818. July 1980. SFA 26(1)
[Arasaki Mar. Biol. Stn., Tokai Reg. Fish. Res. Lab., Arasaki, Nagai, Yokosuka 238-03, Japan] The effects of repeated treatments of HCG on ovulation and egg qualities in ayu were investigated in this study. HCG 1000 or 750 IU-treated fish indicated high percentages of fertilization and hatching, whereas in HCG 500 or 100 IU-treated fish the values were very low. Other indices such as egg stage and water content of eggs were also different between groups receiving single or repeated injections of HCG. In correspondence to the change in egg qualities the fish treated with 1000 or 750 IU showed an increase in body weight. But the groups receiving repeated injections of HCG 500 or 100 IU showed a decrease in body weight. Thus body weight change may be an appropriate index for determing egg quality. In the groups treated with repeated injections of HCG 500 or 100 IU the serum corticoids were higher than in the saline of HCG 1000 IU group. Furthermore, the relationship between these high titers of corticoids and egg quality was discussed.

81-000033 Shafland, P. L. and D. H. Koehl. LABORATORY REARING OF THE COMMON SNOOK. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:425-431. 1979(1980). SFA 26(1)
[Fla. Game Fresh Water Fish Comm., 801 N.W. 40th St., Boca Raton 33431] Culturability of snook (*Centropomus undecimalis*) was evaluated in laboratory studies during the summers of 1975-1977. This is the first report of snook being reared from artifically fertilized eggs. No snook survived longer than 11 days in the 1975 experiments, although about 50 and 250 were reared through metamorphosis and beyond in the experiments of 1976 and 1977, respectively. These snook were reared in closed saltwater rearing systems for 14-16 days, after which they were converted to fresh water and stocked in 0.01 ha ponds. In our studies, snook were not cannibalistic at sizes less than 20 mm TL; withstood low overnight dissolved oxygen concentrations of less than 1.0 ppm; and could be converted to fresh water at 15 days of age. Snook 15 days and older are relatively hardy, and if procedures could be developed to rear them to this age in large numbers, culture of fingerling snook could become a routine matter.

81-000034 Trimble, W. C. YIELD TRAILS FOR RED DRUM IN BRACKISH-WATER PONDS, 1976-1979. *Proc. Annu. Conf. Southeast. Assoc. Fish Wild. Agencies* 33:432-441. 1979(1980). SFA 26(1)
[St. Martin Land Co., 311 Toronto Drive, Lafayette, LA 70507] In 2 trials during 1976-1979, juvenile red drum (*Sciaenops ocellata*) were reared to marketable size (454 g) in 0.08-ha, brackish-water ponds at the Claude Peteet

MARICULTURE (CONTINUED)

81-000034 CONTINUED Mariculture Center. In Trial I, survivors from a nursery pond were stocked in 2 production ponds, fed a commercial feed, and harvested when 394 or 532 days old. Less than 1% of drum from the first harvest were marketable, and yield was 787 kg/ha with 210-g mean weight, 89% survival, and 2.8 feed conversion. Twenty-one percent from the second harvest were marketable, and yield was 1,062 kg/ha with 335-g mean weight, 75% survival, and 4.6 feed conversion. In Trial II, red drum from a second nursery pond were restocked in periodically drained production ponds, fed commercial feeds, then harvested when 715 days old. Standing crop of drum was 2,292 kg/ha during Trial II, and 33% of the drum were marketable at harvest. A 40% protein feed ($0.62/kg) poses an economic barrier in Alabama for mariculture of red drum dock-valued at $0.66 to $0.88/kg. Effect of 25% protein feed ($0.44/kg) on production of red drum was negated by a fungous epizootic.

FEEDS, FEEDING, AND NUTRITION

81-000035 Appelbaum, S. ZUR AUFNAHME VON GRANULIERTEM FUTTER BEI AALEN (*ANGUILLA ANGUILLA* L.) UND DESSEN EINWIRKUNG AUF DAS AUSEINANDERWACHSEN DER FISCHE. [THE ACCEPTANCE OF GRANULATED FOOD BY THE EEL (*ANGUILLA ANGUILLA* L.) AND ITS INFLUENCE ON THE GROWTH OF THE INDIVIDUALS.] *Arch. Fischereiwiss.* 31(1):15-20. July 1980. In German with English summ. SFA 26(1)

[Zool. Inst., Zool. Mus., Univ. Hamburg, West Germany] Eels are generally fed on pasty food. In the following investigation granulated food was offered to pigmented elvers. The food intake as well as the variation in growth of the individuals were observed. The results have shown that pigmented elvers are ready and willing to take granulated food which was given in the beginning together with Tubifex, in order to adapt the fish to the food. The variation in growth of the individuals fed on granulated food was comparable with that of animals fed on paste. In view of the water pollution and the loss of food as well as labour input during the feeding of eels, granulated food (possibly water stable and floating pellets), seems to be advantageous.

81-000036 Appelbaum, S. ZUR FREßLUST DER REGENBOGENFORELLEN (*SALMO GAIRDNERI* RICHARDSON) BEI DER AUFNAHME VON AROMATISIERTEM BZW. NICHT AROMATISIERTEM FUTTER. [THE INFLUENCE OF FLAVOURING OF FOOD ON THE INGESTION BY RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON). *Arch. Fischereiwiss.* 31(1):21-27. July 1980. In German with English summ. SFA 26(1)

[Zool. Inst., Zool. Mus., Univ. Hamburg, West Germany]

81-000037 Arlati, G. SVEZZAMENTO DI "RAGANI" SELVATICI DI ANGUILLA MEDIANTE USO ESCLUSIVO DI MANGIME. [USE OF ARTIFICAL FOOD AS A "STARTER" FOR WILD FINGERLING EELS.] *Riv. It. Piscic. Ittiop.* 15(3):87-91. July-Aug.-Sept. 1980. In Italian with English summ. SFA 26(1)

[Via Console Marcello 18/1, 20156 Milano, Italy]

81-000038 Bryant, P. L. and A. J. Matty. OPTIMISATION OF *ARTEMIA* FEEDING RATE FOR CARP LARVAE (*CYPRINUS CARPIO* L.). *Aquaculture* 21(3):203-212. Nov. 1980. SFA 26(1)

[Dep. Biol. Sci., Univ. Aston Birmingham, Gosta Green, Birmingham B4 7ET, England] Carp (*Cyprinus carpio*) larvae were fed on measured numbers of *Artemia* nauplii, and daily growth of the larvae monitored for a period of 10 days in order to determine the effect of varying feeding levels. A 34% reduction in specific growth rate was observed over the experimental period. At a temperature of 24 ± 0.5°C, carp larvae were found to require

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

81-000038 CONTINUED 200-250% of their body weight of *Artemia* nauplii per day for optimal growth and food conversion during the first five days of feeding, reducing to 100-120%/day over the following five days. The significance of these results is discussed in relation to potential economics of *Artemia* cyst use in hatcheries.

81-000039 Dabrowski, K.; S. Hassard; J. Quinn; T. J. Pitcher and A. M. Flinn. EFFECT OF *GEOTRICHUM CANDIDUM* PROTEIN SUBSTITUTION IN PELLETED FISH FEED ON THE GROWTH OF RAINBOW TROUT (*SALMO GAIRDNERI* RICH.) AND ON UTILIZATION OF THE DIET. *Aquaculture* 21(3):213-232. Nov. 1980. SFA 26(1)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn, Kortowo, Poland]

81-000040 Falls, W. W. ECONOMICAL, AUTOMATIC, DRY-FOOD FISH FEEDER. *Prog. Fish-Cult.* 42(4):240. Oct. 1980. SFA 26(1)
[Sect. Anadromous Fishes, Gulf Coast Res. Lab., Ocean Springs 39564]

81-000041 Hata, K. and T. Kaneda. EFFECT OF AUTOXIDIZED OIL ON CARP. *Bull. Jpn. Soc. Sci. Fish.* 46(8):997-1000. Aug. 1980. SFA 26(1)
[Dep. Food Chem., Fac. Agric., Tohuku Univ., Amamiya-machi, Tsutsumidori, Sendai 980, Japan] It is known that carp fed autoxidized oil reveal poor growth, high mortality and characteristic muscular dystrophy called "Sekoke" disease. But it has not been clarified as to what is the main toxic substance in autoxidized oil. To determine the exact effect of autoxidized products, pure methyl linoleate hydroperoxide and secondary decomposition products were prepared, and a feeding experiment was carried out using carp for 120 days. The results indicate that both of these autoxidized oils induced muscular dystrophy, poor growth and inactivation of enzymes such as succinate dehydrogenase. The degree of their toxic effect was almost equal. In the group fed with methyl linoleate hydroperoxide, an increase of carbonyl compounds was observed in the lipids extracted from intestine and adipose tissue, although accumulation of peroxide was not recognized. These results suggest the conversion of lipid peroxide to carbonyl compounds in intestinal tissue.

81-000042 Hille, S.; J. Deufel; H. Kausch and F. Platz. ENTSTEHUNG EINES FETTLEBERSYNDROMS BEI REGENBOGENFORELLEN (*SALMO GAIRDNERI*) IN ABHÄNGIGKEIT VOM KOHLENHYDRAT- UND PROTEINGEHALT DES FUTTERS, SOWIE BEI ÜBERFÜTTERUNG. [THE INFLUENCE OF CARBOHYDRATE AND PROTEIN CONTENT OF THE FEED, AS WELL AS OVERFEEDING, ON THE DEVELOPMENT OF FATTY LIVER IN RAINBOW TROUT (*SALMO GAIRDNERI*).] *Arch. Hydrobiol. Supplementb.* 59(1):1-16. 1980. In German with English summ. SFA 26(1)
[Inst. Seenforsch. Fischereiwesen, Langenargen, West Germany] Fatty degeneration of rainbow trout livers developed after excess feeding and after diets with a high percentage of carbohydrate. Growth, nutrient quotient, hepatic weight and fat content, hematocrit, haemoglobin, plasma cholesterol levels and the histology of the liver were studied at three levels of carbohydrate and protein in the food. No ceroid occured. It is concluded that it is not possible to satisfy the caloric demand by the replacement of different types of protein with carbohydrates consisting of extruded wheat starch, without injuring the health of the rainbow trout.

81-000043 Hogendoorn, H. CONTROLLED PROPAGATION OF THE AFRICAN CATFISH, *CLARIAS LAZERA* (C. & V.) III. FEEDING AND GROWTH OF FRY. *Aquaculture* 21(3):233-241. Nov. 1980. SFA 26(1)
[Agric. Univ., Dep. Fish Cult. Inland Fish., P.O. Box 338, Wageningen, The Netherlands] The suitability of some common, natural and artificial feedstuffs for the rearing of fry of *Clarias lazera* (C. & V.) was

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

81-000043 CONTINUED investigated in 2 experiments. It was found that a dry trout starter, an experimental dry feed and dried inactive yeast were not suitable feeds for rearing *C. lazera* fry. Neither could ground *Clarias* fingerlings or frozen zooplankton be used. By contrast, frozen *Artemia* and especially live *Artemia* and live zooplankton gave good results. After 4 weeks the fish thus fed had attained an average weight of 0.3 to 1 g and survival ranged from 50 to 96%. Feeding in excess of satiation and feeding 24 h/day gave the fastest growth, although the differences in comparison with feeding *Artemia* or live zooplankton to satiation 4 times per day were not significant. The specific growth rate (% body weight) of these fish decreased from 68% at the start of the experiment to 9% after 28 days.

81-000044 Jafri, A. K.; M. Al-Judaimi and K. A. George. PRELIMINARY INVESTIGATIONS FEEDING YELLOW-FINNED BLACK PORGY, *ACANTHOPAGRUS LATUS* (HOUTTUYN), WITH ARTIFICAL FEED. *Aquaculture* 22(1-2):117-124. Jan. 1981. SFA 26(1)

[Maricult. Fish. Dep., Kuwait Inst. Sci. Res., P.O. Box 1638, Salmiya Kuwait] Feeding trials on yellow-finned black porgy, *Acanthopagrus latus*, were conducted with pelleted feed developed from locally available ingredients, supplemented with essential vitamin and mineral premixes. The diet was assessed for its proximate composition and nutritive value. An evaluation of the performance of the diet was made in terms of weight gain, conversion and protein efficiencies. The results indicate that the locally developed feed in its present or subsequently improved form could be used for the culture of this species in Kuwait.

81-000045 Kentouri, M. ELEVAGE DES LARVES DE LOUP (*DICENTRARCHUS LABRAX*, L.) A L'AIDE D'ORGANISMES DU ZOOPLANCTON CONGELE: RESULTATS PRELIMINAIRES. [REARING OF SEA-BASS (*DICENTRARCHUS LABRAX* L.) LARVAE ON FROZEN ZOOPLANKTON: PRELIMINARY RESULTS.] *Aquaculture* 21(2):171-180. Oct. 1980. In French with English summ. SFA 26(1)

[Stn. Biol. Mar. Lagunaire, 34200 Sete, France] Larvae (fry) of sea bass (*Dicentrarchus labrax* L.) were successfully reared from the mouth-opening stage to the age of 120 days being fed only on frozen zooplankton (Rotifera, Copepoda and Daphnia). This inert food is well accepted when left in the water less than 4 h. after being thawed, but is rejected afterwards. The larval development can be compared to that obtained by artificial food and the survival rate is similar to that obtained by living plankton.

81-000046 Ketola, H. G. INFLUENCE OF VARIOUS DIETARY FISH MEALS ON THE GROWTH OF FRY OF ATLANTIC SALMON. *Fish Health News* 9(1):i-ii. Jan. 1980. SFA 26(1)

[U.S. FWS, Tunison Lab., Fish Nutr., 28 Gracie Rd., Cortland, NY 13045]

81-000047 Lovell, R. T. FACTORS AFFECTING VOLUNTARY FOOD CONSUMPTION BY CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:563-571. 1979(1980). SFA 26(1)

[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830] Nutritional and physical properties of the diet, management, and environment affect voluntary food consumption by channel catfish (*Ictalurus punctatus*). Laboratory studies in which channel catfish were fed twice daily to satiation with semipurified diets containing various ratios of protein and digestible energy indicated that food intake was directly proportional to calorie density in the diet but independent of protein density until the protein percentage exceeded 45. Protein levels above 45% caused reduced food intake. Pond experiments in which channel catfish were fed to satiation twice daily, once daily, or on alternate days demonstrated that fish fed twice daily consumed the most food when water temperature was 26C or greater, those fed once daily consumed the most food at 2-26C, and those fed on alternate days

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

81-000047 CONTINUED consumed the most food when temperature declined below 20C. Channel catfish fed to satiation once daily in ponds consumed 17% more of an extruded feed that had a mass density of 0.92 g/cm^3 than one having a density of 0.83 g/cm^3 even though the former had a higher calorie density, indicating that stomach fill limited food intake.

81-000048 Mackie, A. M.; J. W. Adron and P. T. Grant. CHEMICAL NATURE OF FEEDING STIMULANTS FOR THE JUVENILE DOVER SOLE, *SOLEA SOLEA* (L.). *J. Fish Biol.* 16(6):701-708. June 1980. SFA 26(1)
[Inst. Mar. Biochem. (Nat. Environ. Res. Council), Aberdeen AB1 3RA, Scotland] Juvenile Dover sole, *Solea solea*, were weaned from a live food, *Artemia salina* nauplii, on to a casein-based particulate diet flavoured with flesh of the mussel, *Mytilus edulis*. These fish would not accept an unflavoured casein-based diet but readily ate the diet flavoured with either mussel flesh or a mixture of pure chemicals whose composition was based on an analysis of the low-molecular weight fraction of mussel flesh. The rate of growth and survival over a seventy-seven day period was essentially the same on either of the flavoured diets. The active constituent in the mixture of pure chemicals was identified as glycine betaine for fish of wet weight exceeding 50 g while glycine betaine with certain L-amino-acids was required for fish of about 2-5 g wet weight. These results are discussed in relation to the known feeding behaviour and food preferences of the wild Dover sole.

81-000049 Pfeffer, E. and A. Barte. EINFLÜSSE DER PROTEIN-UND FETTRÄGER IM FUTTER AUF DIE LEBER-VERFETTUNG BEI REGENBOGENFORELLEN (*SALMO GAIRDNERI*, R.). [INFLUENCES OF THE SOURCES OF DIETARY PROTEIN AND FAT ON FATTY LIVERS IN RAINBOW TROUT.] *J. Anim. Physiol. Anim. Nutr.* 44(3):172-177. 1980. In German with English summ. SFA 26(1)
[Inst. Tierphysiol. Tierernahrung, Univ. Göttingen, West Germany]

81-000050 Plakas, S. M.; T. Katayama; Y. Tanaka and O. Deshimaru. CHANGES IN THE LEVELS OF CIRCULATING PLASMA FREE AMINO ACIDS OF CARP (*CYPRINUS CARPIO*) AFTER FEEDING A PROTEIN AND AN AMINO ACID DIET OF SIMILAR COMPOSITION. *Aquaculture* 21(4):307-322. Dec. 1980. SFA 26(1)
[Dep. Aquacult. Sci. Pathol., Univ. R.I., Kingston 02881]

81-000051 Poston, H. A. and G. F. Combs, Jr. INTERRELATIONSHIPS BETWEEN REQUIREMENTS FOR DIETARY SELENIUM, VITAMIN E, AND L-ASCORBIC ACID BY ATLANTIC SALMON (*SALMO SALAR*) FED A SEMIPURIFIED DIET. *Fish Health News* 8(4):vi-vii. Oct. 1979. SFA 26(1)
[Tunison Lab. Fish Nutr., Cortland, NY 13045]

81-000052 Quantz, G. ÜBER DEN EINFLUß VON CAROTINOIDREICHEM TROCKENFUTTER AUF DIE EIBEFRUCHTUNG DER REGENBOGENFORELLE (*SALMO GAIRDNERI* R.). [THE INFLUENCE OF CAROTENOID-ENRICHED DRY FEED ON THE EGG FERTILIZATION OF RAINBOW TROUT (*SALMO GAIRDNERI* R.).] *Arch. Fischereiwiss.* 31(1):29-40. July 1980. In German with English summ. SFA 26(1)
[Inst. Meereskd., Univ. Kiel, West Germany]

81-000053 Reinitz, G. ACCEPTABILITY OF ANIMAL FAT IN DIETS FOR RAINBOW TROUT AT TWO ENVIRONMENTAL TEMPERATURES. *Prog. Fish-Cult.* 42(4):218-222. Oct. 1980. SFA 26(1)
[U.S. FWS, Spearfish Fish. Cent., P.O. Box 352, Spearfish, SD 57783]

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

81-000054 Reinitz, G. and R. Austin. PRACTICAL DIETS FOR INTENSIVE CULTURE OF WALLEYES. *Prog. Fish-Cult.* 42(4):212-214. Oct. 1980. SFA 26(1)
[U.S. FWS, Spearfish Fish. Cent., P.O. Box 352, Spearfish, SD 57783]

81-000055 Rungruangsak, K. and F. Utne. EFFECT OF DIFFERENT ACIDIFIED WET FEEDS ON PROTEASE ACTIVITIES IN THE DIGESTIVE TRACT AND ON GROWTH RATE OF RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON). *Aquaculture* 22(1-2):67-79. Jan. 1981. SFA 26(1)
[Dep. Biochem., Fac. Sci., Mahidol Univ., Rama VI Rd., Bangkok, Thailand] Acidified feeds treated with hydrochloric, formic or sulphuric acid were fed to rainbow trout (*Salmo gairdneri* Richardson) to test the effects on protease activities, growth and feed utilization. The acidified feeds were prepared by mixing a frozen stored control feed with fish silage made from the same feed acidified with 2.5% (*w/w*) of hydrochloric acid, formic acid or sulphuric acid, respectively. To the silages was added 0.5% (*w/w*) propionic acid as a fungicide. The experimental feeds contained 0, 40, 60 and 100% of the fish silages to give final concentrations of, respectively, 0, 1.0, 1.5, and 2.5% (*w/w*) of each acid tested. Hydrochloric acid had no apparent effect on growth or proteolytic activities in any part of the digestive tract. Formic acid at all levels tested seems to have a depressive effect on both growth and proteolytic activities. Sulphuric acid showed similar effects, with the exception that the protease activity in the stomach was not depressed. Acidified feeds showed lower feed utilizations than the control feed, this being most pronounced for the formic acid silage.

81-000056 Shimeno, S.; H. Hosokawa; M. Takeda and H. Kajiyama. [EFFECTS OF CALORIE TO PROTEIN RATIOS OF FORMULATED DIET ON THE GROWTH, FEED CONVERSION AND BODY COMPOSITION OF YOUNG YELLOWTAIL.] *Bull. Jpn. Soc. Sci. Fish.* 46(9):1083-1087. Sept. 1980. In Japanese with English summ. SFA 26(1)
[Dep. Cult. Fish., Fac. Agric., Kochi Univ., Nankoku 783, Japan]

81-000057 Smith, R. R.; M. C. Peterson and A. C. Allred. EFFECT OF LEACHING ON APPARENT DIGESTION COEFFICIENTS OF FEEDSTUFFS FOR SALMONIDS. *Prog. Fish-Cult.* 42(4):195-199. Oct. 1980. SFA 26(1)
[U.S. FWS, Tunison Lab. Fish Nutr., Rt. 1, Box 256-1, Hagerman, ID 83332]

81-000058 Viola, S. and G. Amidan. OBSERVATIONS ON THE ACCUMULATION OF FAT IN CARP AND *SAROTHERODON* (TILAPIA) FED OIL-COATED PELLETS. *Bamidgeh* 32(2):33-40. June 1980. SFA 26(1)
[Milobar Cent. Feedmill, D. N. Asherath, Israel] The effects of feeding oil-coated pellets to carp and *Sarotherodon* on fat accumulation and fatty acid composition were recorded during feeding experiments in ponds and in cages. Carp from storage ponds and from grow out ponds contained more fat and dry matter than *Sarotherodon*. Carp fat was characterised by a higher content of 18:1, whereas *Sarotherodon* was richer in lower saturated acids, particularly 16:0. Standard pellets fed for 50 days caused an accumulation of fat around the viscera of *Sarotherodon*, whereas in carp the viscera contained only 2% more than the carcass. Oil coatings raised the fat content of both parts of carp equally, by 2.3%, in *Sarotherodon* the viscera fat alone was increased by 4%. The fatty acid composition of different feed oils was imprinted on the basic pattern of carp and *Sarotherodon* fat. The lower and saturated fatty acids were less susceptible to changes than the unsaturated and long fatty acids. In *Sarotherodon* the abdominal fat showed larger changes than the carcass fat.

81-000059 Watanabe, T.; T. Takeuchi; A. Murakami and C. Ogino. THE AVAILABILITY TO *TILAPIA NILOTICA* OF PHOSPHORUS IN WHITE FISH MEAL. *Bull. Jpn. Soc. Sci. Fish.* 46(7):897-899. July 1980. SFA 26(1)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan-4, Minato-ku, Tokyo 108, Japan]

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

81-000060 Willis, D. W. and S. A. Flickinger. TRAINING SUCCESS OF BROOK, BROWN, AND LAKE TROUT FRY ONTO A PREPARED DIET. *Prog. Fish-Cult* 42(4):241-242. Oct. 1980. SFA 26(1)
[Dep. Biol., Pittsburg State Univ., Pitsburg, KS 66762]

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

81-000061 Boyd, C. E. and M. L. Cuenco. REFINEMENTS OF THE LIME REQUIREMENT PROCEDURE FOR FISH PONDS. *Aquaculture* 21(3):293-299. Nov. 1980. SFA 26(1)
[Dep. Fish. Allied Aquacult., Agric. Exp. Stn., Auburn Univ., Auburn, AL] Agricultural limestone reacted to a depth of approximately 15 cm in pond sediment during a period of 2 years. The weight of the upper 15-cm layer of sediment in fish ponds averaged 1,407,000 kg/ha. The estimated number of sediment samples required for allowable errors in lime requirement of ± 500, ± 750, and ± 1000 kg/ha of $CaCO_3$ are presented for ponds with areas of <0.4-10.3 ha. The residual effect of liming, based on results from laboratory mud-water systems, should last for about 10 water exchanges.

81-000062 Monk, B. H.; C. W. Long and E. M. Dawley. FEASIBILITY OF SIPHONS FOR DEGASSING WATER. *Trans. Am. Fish. Soc.* 109(6):765-768. Nov. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

81-000063 Scott, A. P. and S. M. Baynes. A REVIEW OF THE BIOLOGY, HANDLING AND STORAGE OF SALMONID SPERMATOZOA. *J. Fish. Biol.* 17(6):707-739. Dec. 1980. SFA 26(1)
[Minist. Agric. Fish. Food, Fish Lab., Lowestoft NR33 0HT, England] Several aspects of salmonid sperm have been critically reviewed: structure, density, volume, chemical composition, metabolism, fertilisation techniques, motility, dilution, activation, storage at temperatures above and below 0°C and cryopreservation.

81-000064 Stoss, J. and W. Holtz. CRYOPRESERVATION OF RAINBOW TROUT (*SALMO GAIRDNERI*) SPERM I. EFFECT OF THAWING SOLUTION, SPERM DENSITY AND INTERVAL BETWEEN THAWING AND INSEMINATION. *Aquaculture* 22(1-2):97-104. Jan. 1981. SFA 26(1)
[Inst. Tierzucht Haustiergenet., Univ. Göttingen, Albrecht-Thaer-Weg 1, 3400 Göttingen, West Germany] Three experiments were conducted to improve the presently available technique for cryopreservation of rainbow trout sperm. In every case semen was diluted with an extender, pellet-frozen on dry ice and stored in liquid nitrogen. In a comparison of several thawing solutions best results were obtained with coelomic fluid, 119 m mol $NaHCO_3$, and 120 m mol NaCl (78.9, 75.3 and 69.1% fertilization, respectively, compared with 97.1% for controls). The lowest density of frozen sperm cells required to obtain satisfactory fertilization rates was determined to be 3 x 10^6 sperm/egg. A delay of as little as 30 s between thawing of pellets and addition of sperm to eggs resulted in a reduced fertilization rate.

GENERAL LIMNOLOGY AND OCEANOGRAPHY

81-000065 Charlton, M. N. HYPOLIMNION OXYGEN CONSUMPTION IN LAKES: DISCUSSION OF PRODUCTIVITY AND MORPHOMETRY EFFECTS. *Can. J. Fish. Aquatic Sci.* 37(10):1531-1539. Oct. 1980. In English with French summ. SFA 26(1)
[Natl. Water Res. Inst., Burlington, ON L7R 4A6, Canada]

CHEMICAL LIMNOLOGY AND OCEANOGRAPHY

81-000066 Cuenco, M. L. and R. R. Stickney. RELIABILITY OF AN ELECTRODE AND A WATER ANALYSIS KIT FOR DETERMINATION OF AMMONIA IN AQUACULTURE SYSTEMS. *Trans. Am. Fish. Soc.* 109(5):571-576. Sept. 1980. SFA 26(1)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

81-000067 Nakashima, B. S. and W. C. Leggett. THE ROLE OF FISHES IN THE REGULATION OF PHOSPHORUS AVAILABILITY IN LAKES. *Can. J. Fish. Aquatic Sci.* 37(10):1540-1549. Oct. 1980. In English with French summ. SFA 26(1)
[W. C. Leggett: Dep. Biol., McGill Univ., Montreal, PQ H3A 1B1, Canada]

BENTHOS

81-000068 Buchanan, A. C. MUSSELS (NAIADES) OF THE MERAMEC RIVER BASIN. *Mo. Dep. Conserv. Aquatic Ser.* No. 17. 68p. Oct. 1980. Available from Mo. Dep. Conserv., 1110 College Ave., Columbia 65201. SFA 26(1)

MORPHOLOGY

81-000069 Bemis, W. PAEDOMORPHOSIS AND THE EVOLUTION OF LUNGFISHES (DIPNOI). *Am. Zool.* 20(4):757. 1980. Abstract only. SFA 26(1)
[Univ. Calif., Berkeley]

81-000070 Benjamin, M. VACUOLATED PROLACTIN CELLS IN THE PITUITARY GLAND OF SEVERAL MARINE TELEOSTS. *J. Zool. (Lond.)* 192(1):59-69. Sept. 1980. SFA 26(1)
[Dep. Anat., University College, Cardiff, Wales]

81-000071 Bianco, P. G. and T. T. Nalbant. REDESCRIPTION OF *COBITIS LINEA*, WITH SOME REMARKS ON THE SUBGENUS *BICANESTRINIA* (CYPRINIFORMES: COBITIDAE). *Copeia* 1980(4):903-906. 5 Dec. 1980. SFA 26(1)
[Inst. Zool., Univ. Piazza Regina Margherita 7, 67100 L'Aquila, Italy]

81-000072 Braekevelt, C. R. ON THE PRESENCE OF WANDERING PHAGOCYTES AT THE PHOTORECEPTOR-RETINAL EPITHELIAL JUNCTION IN THE GOLDEYE (*HIODON ALOSOIDES*) (TELEOST). *Am. Zool.* 20(4):785. 1980. Abstract only. SFA 26(1)
[Univ. Manitoba, Winnipeg, MB, Canada]

MORPHOLOGY (CONTINUED)

81-000073 Bruce, R. W. ON THE OCCURRENCE OF VERY SMALL TERMINAL PHASE PARROTFISHES. *Copeia* 1980(4):887-889. 5 Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. West Indes, St. Augustine, Trinidad]

81-000074 Burdak, V. D. THE PROTECTIVE FUNCTION OF SCALE COVER OF FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):101-107. 1979.
SFA 26(1) [Inst. Biol. South. Seas, Ukrainian SSR Acad. Sci., Sevastopol, USSR]

81-000075 Buynak, G. L. and H. W. Mohr, Jr. LARVAL DEVELOPMENT OF GOLDEN SHINER AND COMELY SHINER FROM NORTHEASTERN PENNSYLVANIA. *Prog. Fish-Cult.* 42(4):206-211. Oct. 1980. SFA 26(1)
[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603]

81-000076 Chatry, M. F. and J. V. Conner. COMPARATIVE DEVELOPMENT MORPHOLOGY OF THE CRAPPIES, *POMOXIS ANNULARIS* AND *P. NIGROMACULATUS*. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 45-57. Sept. 1980. SFA 26(1)
[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle 70358] Lab-reared and wild-caught larvae of *Pomoxis annularis* and *P. nigromaculatus* from southeastern Louisiana are compared in terms of general morphology, pigment, and osteology. White and black crappie can be distinguished earliest as fully straightened yolk sac protolarvae (ca. 2.5 to 3.8 mm TL) by the position of the oil globule. In *P. annularis* the oil globule is generally in the posterior half of the yolk sac and in *P. nigromaculatus* the oil globule is centrally or anteriorly placed. From about 4.0 to 13.0 mm TL separation of the two species is possible on the basis of the distance from the posterior margin of the eye to the anteriormost portion of the swim bladder. This distance, when expressed in terms of total length, is greater than 15% in white crappie and less than 15% in black crappie. For larvae about 13.0 to 16.0 mm TL the only diagnostic character is the number of predorsal bones, which requires clearing and staining to observe. *P. annularis* has seven or more predorsal bones (rarely 6) and *P. nigromaculatus* has six or fewer. Larvae and early juveniles 16.0 mm TL and larger can be identified by using the ratio of dorsal fin length to the distance from the eye to the leading edge of the dorsal fin. Length of the dorsal fin is equal to or included in the eye to dorsal fin distance in white crappie, whereas the dorsal fin length in black crappie is always greater than the eye to dorsal fin distance. Sizes at which certain developmental milestones occur can aid in discriminating the two *Pomoxis* species. Certain inconsistencies with the literature are noted, emphasizing the need for comparative study and consideration of geographic variation.

81-000077 Cohen, J. L. FUNCTIONAL ORGANIZATION OF THE RETINA OF THE LEMON SHARK (*NEGAPRION BREVIROSTRIS*, POEY): AN ANATOMICAL AND ELECTROPHYSIOLOGICAL APPROACH. *Ph.D. dissertation, Univ. Miami* 154p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1201. Oct. 1980. SFA 26(1)

81-000078 D'Vincent, S.; H. G. Moser and E. H. Ahlstrom. DESCRIPTION OF THE LARVAE AND EARLY JUVENILES OF THE PACIFIC BUTTERFISH, *PEPRILUS SIMILLIMUS* (FAMILY STROMATEIDAE). *Calif. Coop. Oceanic Fish. Invest.* 21:172-179. July 1980. SFA 26(1)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

81-000079 Douglas, M. E. and J. A. Endler. COMPLEX COLOR PATTERNS IN MALE *POECILIA RETICULATA*: THE TESTING OF ALTERNATIVE EVOLUTIONARY MODELS. *Am. Zool.* 20(4):781. 1980. Abstract only. SFA 26(1)
[Rutgers Univ., New Brunswick, NJ]

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81-000080 Egginton, S. and I. A. Johnston. ULTRASTRUCTURAL HETEROGENEITY OF FISH FAST MUSCLE FIBRES. *J. Physiol. (Lond.)* 310:28P. Jan. 1981. SFA 26(1)
[Dep. Physiol. Pharmacol., Univ. St. Andrews, St. Andrews, Fife KY16 9TS, Scotland]

81-000081 Ezeasor, D. N. and W. M. Stokoe. A CYTOCHEMICAL, LIGHT AND ELECTRON MICROSCOPIC STUDY OF THE EOSINOPHILIC GRANULE CELLS IN THE GUT OF THE RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Biol.* 17(6):619-634. Dec. 1980. SFA 26(1)
[Dep. Vet. Anat. Physiol., Univ. Nigeria, Nsukka, Nigeria] The distribution, morphology and cytochemistry of the eosinophilic granule cells in the gut of the rainbow trout, *Salmo gairdneri*, were studied using light and electron microscopes. Granule cells were associated generally with the propria of the gut wall, the majority being arranged in a definitive layer, as a stratum granulosum. The cytoplasm of the eosinophilic granule cells contained numerous spherical, membrane-bound, homogeneous electrondense granules, ranging from 0·1-1·3 μm in diameter. A portion of the cytoplasm located towards one pole of the cell was usually devoid of organelles other than ribosomes. Whatever their location, the eosinophilic granule cells were always associated with fixed connective tissue cells, referred to here as 'ensheathing' cells. Phospholipid, acid mucopolysaccharide and the activities of alkaline phosphatase, acid phosphatase, arylsulphatase and 5-nucleotidase were demonstrated in the granules. It is hypothesized that the 'ensheathing' cells and eosinophilic granule cells constitute a part of the body defence mechanism.

81-000082 Ezeasor, D. N. and W. M. Stokoe. SCANNING ELECTRON MICROSCOPIC STUDY OF THE GUT MUCOSA OF THE RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish Biol.* 17(5):529-539. Nov. 1980. SFA 26(1)
[R. Sch. Vet. Stud., Summerhall, Edinburgh EH9 1QH, Scotland]

81-000083 Fernald, R. D. and P. R. Johns. RETINAL SPECIALIZATION AND GROWTH IN THE CICHLID FISH, *HAPLOCHROMIS BURTONI*. *Am. Zool.* 20(4):942. 1980. Abstract only. SFA 26(1)
[Univ. Oreg., Eugene]

81-000084 Frietsche, R. A. and C. F. Bailey. THE HISTOLOGY AND CALCIFICATION OF REGENERATING SCALES IN THE BLACKSPOTTED TOPMINNOW, *FUNDULUS OLIVACEUS* (STORER). *J. Fish Biol.* 16(6):693-700. June 1980. SFA 26(1)
[U.S. FWS, P.O. Box 705, Ouachita Baptist Univ., Arkadelphia, AR 71923] The regenerating scale and tissues comprising the scale pocket of *Fundulus olivaceus* were examined microscopically at specific intervals. Scale removal resulted in a thickening of the epidermis which persisted through the early stages of regeneration. This thickening was due in part to the appearance of columnar basal cells which divided producing cells that became mucous cells and squamous cells. The scale regenerated as a relatively large plate of bone which first appeared between layers of scleroblasts on the floor of the scale pocket and then grew producing circuli and radii. By the fourth day of regeneration, calcium was observed in the cytoplasm of the scleroblasts and at randomly distributed foci in the osseous portion of the scale. The osseous layer was completely calcified by 15 days of regeneration.

81-000085 Fuiman, L. A. and J. R. Trojnar. FACTORS AFFECTING EGG DIAMETER OF WHITE SUCKERS *(CATOSTOMUS COMMERSONI)*. *Copeia* 1980(4):699-704. 5 Dec. 1980. SFA 26(1)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

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81-000086 Gajdůšek, J. BIOMETRICS OF BREAM, *ABRAMIS BRAMA*. *Acta Sci. Nat. Brno* 14(8):1-33. 1980. In English with Russian summ. SFA 26(1)
[Inst. Vert. Zool., Czeck. Acad. Sci., Květná 8, 603 65 Brno, Czechoslovakia]

81-000087 Ghiot, F. and N. Bouchez. THE CENTRAL ROD OF THE BARBELS OF A SOUTH AMERICAN CATFISH, *PIMELODUS CLARIAS*. *Copeia* 1980(4):908-909. 5 Dec. 1980. SFA 26(1)
[Univ. Liège, Lab. Morphol., Quai Van Benedin, 22, B-4020, Liège, Belgium]

81-000088 Gilbertson, L. G. VARIATION AND NATURAL SELECTION IN AN ALASKAN POPULATION OF THE THREESPINE STICKLEBACK (*GASTEROSTEUS ACULEATUS* L.). *Ph.D. dissertation, Univ. Wash.* 1979. From Diss. Abstr. Int. B Sci. Eng. 41(6):2044. Dec. 1980. SFA 26(1)

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[Univ. Calif., Davis]

81-000090 Govoni, J. J. MORPHOLOGICAL, HISTOLOGICAL, AND FUNCTIONAL ASPECTS OF ALIMENTARY CANAL AND ASSOCIATED ORGAN DEVELOPMENT IN LARVAL *LEIOSTOMUS XANTHURUS*. *Rev. Can. Biol.* 39(2):69-80. June 1980. SFA 26(1)
[NMFS, Beaufort Lab., Beaufort, NC 29516] Knowledge of the extent and timing of developmental changes in the alimentary canal and associated organs should provide a basis for evaluating changes in the digestive and assimilative abilities of larval marine fishes during their development. This study describes aspects of the functional development of the alimentary canal, liver, and pancreas of spot, *Leiostomus xanthurus*, in relation to its early life history. The alimentary canal and associated organs become functional at first feeding and change little during the larval phase. Major developmental changes are associated with transformation and are accompanied by changes in habitat and feeding regimen. The expansion of surface area in the larval phase and the complete development of gastric glands during transformation may influence digestion and assimilation.

81-000091 Hart, N. H. and R. Pietri. ULTRASTRUCTURE OF THE CHORION AND ITS FILAMENTS IN *ORYZIAS LATIPES*. *Am. Zool.* 20(4):874. 1980. Abstract only. SFA 26(1)
[Rutgers Univ., New Brunswick, NJ]

81-000092 Hawkins, W. E. ULTRASTRUCTURE OF THE KIDNEY OF A MARINE TELEOST. *J. Miss. Acad. Sci.* 25(Suppl.):130. 1980. Abstract only. SFA 26(1)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

81-000093 Heufelder, G. R. and N. A. Auer. A COMPARISON OF LARVAL *COTTUS BAIRDI* AND *COTTUS COGNATUS* FROM SOUTHEASTERN LAKE MICHIGAN. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 58-68. Sept. 1980. SFA 26(1)
[Great Lakes Res. Div., Inst. Sci. Technol., Univ. Mich., Ann Arbor 48109] Larvae of *Cottus bairdi* (8.1 to 14.7 mm) and *Cottus cognatus* (6.6 to 14.4 mm) from southeastern Lake Michigan are described and morphometric and meristic characters compared. All *C. bairdi* larvae have five pelvic fin elements. At comparable lengths, *C. cognatus* larvae have four pelvic fin

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81-000093 CONTINUED elements. Although less reliable, other characters useful in distinguishing larvae of *C. bairdi* and *C. cognatus* include: anal fin ray count, dorsal fin ray count, and degree of separation of first and second dorsal fins. Our study suggests that an initial investigation of the stability of meristic characters of adult *C. bairdi* and *C. cognatus* in any locality is necessary before the aforementioned distinguishing characters can be applied to identification of larval fishes. Larvae of these two species can be readily distinguished from *C. carolinae* and *Myoxocephalus quadricornis* by myomere count.

81-000094 Howell, W. M.; D. A. Black and S. A. Bortone. ABNORMAL EXPRESSION OF SECONDARY SEX CHARACTERS IN A POPULATION OF MOSQUITOFISH, *GAMBUSIA AFFINIS HOLBROOKI*: EVIDENCE FOR ENVIRONMENTALLY-INDUCED MACULINIZATION. *Copeia* 1980(4):676-681. 5 Dec. 1980. SFA 26(1)
[Dep. Biol., Samford Univ., Birmingham, AL 35209]

81-000095 Jones, G. G. and M. A. Tabery. LARVAL DEVELOPMENT OF THE BANDED KILLFISH (*FUNDULUS DIAPHANUS*) WITH NOTES ON THE DISTRIBUTION IN THE HUDSON RIVER ESTUARY. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 25-35. Sept. 1980. SFA 26(1)
[Ecological Analysts, Inc., RD 2, Goshen Turnpike, Middletown, NY 10940]

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[N.C. Coop. Fish. Res. Unit, N.C. State Univ., Raleigh 27650]

81-000097 Kunz, Y. W. CONE MOSAICS IN A TELEOST RETINA: CHANGES DURING LIGHT AND DARK ADAPTATION. *Experientia (Basel)* 36(12):1371-1374. 15 Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Coll., Dublin 4, Ireland]

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[Inst. Biol. Geol., Univ. Tromsø, P.O. Box 790, N-9001 Tromsø, Norway]

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[Zool. Mus., Univ. Zürich, Zurich-Irche, Winterthurenstr. 190, CH-8057 Zürich, Switzerland]

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[Dep. Zool., Univ. Aberdeen, Tillydrone Ave., Aberdeen, Scotland]

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[Biol. Dep., Malaspina Coll., Nanaimo, BC, Canada]

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[Cell. Cardiol. Res. Group, Inst. Anat., Univ. Bergen, Årstadvein 19, N-5000 Bergen, Norway]

81-000103 Long, R. L. and B. J. Martin. MORPHOLOGY OF PERIPHERAL BLOOD CELLS OF *CYPRINODON VARIEGATUS*. *J. Miss. Acad. Sci.* 25(Suppl.):123. 1980. Abstract only. SFA 26(1)
[Dep. Biol., William Carey Coll., Hattiesburg, MS 39401]

81-000104 McCourt, R. M. and A. N. Kerstitch. MATING BEHAVIOR AND SEXUAL DIMORPHISM IN DENTITION IN THE STINGRAY *UROLOPHUS CONCENTRICUS* FROM THE GULF OF CALIFORNIA. *Copeia* 1980(4):900-901. 5 Dec. 1980. SFA 26(1)
[Dep. Ecol. Evol. Biol., Univ. Ariz., Tucson 85721]

81-000105 Mohsin, A. K. M. THE OSTEOLOGY OF THE GREY MULLET, *LIZA SUBVIRIDIS (VALENCIENNES)*. THE BRANCHIOCRANIUM, VERTEBRAL COLUMN AND GIRDLES. *Malay. Nat. J.* 31(4):203-218. July 1978. SFA 26(1)
[Div. Fish. Mar. Sci., Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia]

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[Univ. Hawaii, Honolulu]

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[Dep. Fish. Oceans, Great Lakes Biolimnol. Lab., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

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[Fish. Lab., Fac. Agric., Nagoya Univ., Furo, Chikusa-ku, Nagoya 464, Japan]

81-000109 Olson, O. P. and N. Watabe. STUDIES ON FORMATION AND RESORPTION OF FISH SCALES. IV. ULTRASTRUCTURE OF DEVELOPING SCALES IN NEWLY HATCHED FRY OF THE SHEEPSHEAD MINNOW, *CYPRINODON VARIEGATUS* (ATHERINIFORMES: CYPRINODONTIDAE). *Cell Tissue Res.* 211(2):303-316. Oct. 1980. SFA 26(1)
[N. Watabe: Electron. Microsc. Cent., Univ. S.C., Columbia 29280]

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[Coll. Fish., Univ. Wash., Seattle 98195]

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81-000111 Pinchuk, V. I. THE LATERAL-LINE SYSTEM OF *CASPIOSOMA CASPIUM* (KESSLER, 1877) AND THE SYSTEMATIC STATUS OF *ASRA TURCOMANUS* ILJIN, 1941. *J. Fish Biol.* 17(2):231-235. Aug. 1980. SFA 26(1)
[Kherson Hydrobiol. Stn., Inst. Hydrobiol., Acad. Sci. Ukrian. SSR, Kherson 325016, USSR] The lateral-line system of the Ponto-Caspian gobiid *Caspiosoma caspium* (Kessler, 1877) is described, with new data on the arrangement of sensory papillae over the head. The systematic status of related forms, especially *Asra turcomanus* Iljin, 1941, is briefly discussed.

81-000112 Porter, R. C. and B. J. Martin. THE HISTOLOGY OF THE POST-PHARYNGEAL DIGESTIVE TRACT OF THE SHEEPSHEAD MINNOW, *CYPRINODON VARIEGATUS*. *J. Miss. Acad. Sci.* 25(Suppl.):122. 1980. Abstract only. SFA 26(1)
[Dep. Biol., William Carey Coll., Hattiesburg, MS 39401]

81-000113 Potter, W. A.; J. J. Loos and J. M. Potter. DEVELOPMENT OF LARVAL BULL CHUB, *NOCOMIS RANEYI*. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 20-24. Sept. 1980. SFA 26(1)
[455 Patuxent Ct., SR-3, La Plata, MD 20646] Larval development of the bull chub, *Nocomis raneyi* is described. Bull chub larvae were reared from artificially spawned adults collected from Elliot Creek, Virginia. Pigment patterns and morphological characters examined were similar to those of two other *Nocomis* species examined and described in the literature. The large, robust *Nocomis* larvae are similar to those of other genera and cannot be separated from the others with confidence.

81-000114 Potthoff, T. DEVELOPMENT AND STRUCTURE OF FINS AND FIN SUPPORTS IN DOLPHIN FISHES *CORYPHAENA HIPPURUS* AND *CORYPHAENA EQUISELIS* (CORYPHAENIDAE). *NOAA Fish. Bull.* 78(2):277-312. Apr. 1980. SFA 26(1)
[NMFS, 75 Virginia Beach Dr., Miami, FL 33149]

81-000115 Powles, P. M.; D. R. Vandeloo and B. Clancy. SOME FEATURES OF LARVAL ROCK BASS, *AMBLOPLITES RUPESTRIS* (RAFINESQUE), DEVELOPMENT IN CENTRAL ONTARIO. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 36-44. Sept. 1980. SFA 26(1)
[Biol. Dep., Trent Univ., Peterborough, ON K9J 7B8, Canada] Rock bass, *Ambloplites rupestris*, eggs, prolarvae, and postlarvae to 17.0 mm (TL) from Chandos Lake, central Ontario, are described and compared to larvae from the Susquehana River, Pennsylvania. Eggs from central Ontario averaged 2.0 mm in diameter, with a centrally located oil globule (0.76 mm) in the yolk. Prolarvae from Pennsylvania have a posterior oil globule and are larger at hatching (5.6 mm, as opposed to 4.9 mm). Pigmentation first appears in 5.8 mm Ontario prolarvae and 6.8 mm Pennsylvania fish; pelvic fin buds are noticable at 9.0 mm (Ontario) and at about 10.5 mm (Pennsylvania). For central Ontario rock bass, juvenile caudal peduncle pigment squares are noted at 40 mm. The SL:TL relationship of central Ontario fish is linear (SL= 0.264 + 0.818 TL, r= 0.998). Snout length to SL and eye diameter to SL plots (curvilinear) are discussed, and morphometrics are presented.

81-000116 Prokeš, M. and M. Peňáz. EARLY DEVELOPMENT OF THE CHUB, *LEUCISCUS CEPHALUS*. *Acta Sci. Nat. Brno* 14(7):1-40. 1980. In English with Russian summ. SF 26(1)
[Inst. Vert. Zool., Czeck. Acad. Sci., Květná 8, 603 65 Brno, Czechoslovakia]

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81-000117 Pshenichnyy, B. P. THE MORPHOMETRIC CHARACTERISTICS OF THE ANGOLAN HAKE, *MERLUCCIUS POLLI*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):17-22. 1979. SFA 26(1)
[VNIRO, Moscow, USSR]

81-000118 Rabalais, N. N.; S. C. Rabalais and D. R. Arnold. DESCRIPTION OF EGGS AND LARVAE OF LABORATORY REARED RED SNAPPER (*LUTJANUS CAMPECHANUS*). *Copeia* 1980(4):704-708. 5 Dec. 1980. SFA 26(1)
[Univ. Tex. Mar. Sci. Inst., Port Aransas Mar. Lab., Port Aransas 78373] Development of laboratory-spawned and reared eggs and larvae of red snapper (*Lutjanus campechanus* Poey) are described and illustrated. The eggs (0.82 mm in diameter) were transparent, spherical, and pelagic. The embryos were unpigmented until 21.5-hr postspawn when dorsal melanophores over the somites were first evident. Day-1 larvae were characterized by an elongate yolk sac in which the oil globule was situated at the extreme anterior end. Absorption of yold sac and oil globule was complete by day 4. Pelvic fins and fin rays did not develop. Overall size of larvae changed very little from hatching (2.2 mm in standard length) to day-4 posthatch (2.5 mm in standard length) when normal morphological development essentially ceased. Transformation of larvae to juveniles did not occur during the period of development observed.

81-000119 Reif, W.-E. DEVELOPMENT OF DENTITION AND DERMAL SKELETON IN EMBRYONIC *SCYLIORHINUS CANICULA*. *J. Morphol.* 166(3):275-288. Dec. 1980. SFA 26(1)
[Inst. Geol. Paläontol., Univ. Tübingen, Sigwartstr. 10, D-7400, Tübingen-1, West Germany]

81-000120 Richardson, S. L.; J. R. Dunn and N. A. Naplin. EGGS AND LARVAE OF BUTTER SOLE, *ISOPSETTA ISOLEPIS* (PLEURONECTIDAE), OFF OREGON AND WASHINGTON. *NOAA Fish. Bull.* 78(2):401-417. Apr. 1980. SFA 26(1)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

81-000121 Ross, S. T. SEXUAL AND DEVELOPMENTAL CHANGES IN SWIMBLADDER SIZE OF THE LEOPARD SEAROBIN, *PRIONOTUS SCITULUS* (PISCES: TRIGLIDAE). *Copeia* 1980(4):611-615. 5 Dec. 1980. SFA 26(1)
[South. Stn. Box 5018, Univ. South. Miss., Hattiesburg 39401]

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[Agric. Res. Organ., Fish Aquacult. Res. Stn., Dor, D. N. Hof-Hacarmel, Isreal]

81-000123 Ruklov, F. N. A DESCRIPTION OF SOME MORPHOPHYSIOLOGICAL CHARACTERS OF SALMON OF THE GENUS *ONCORHYNCHUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):23-40. 1979. SFA 26(1)
[Sakh TINRO, South Sakhalinsk, USSR]

81-000124 Rybachuk, V. K. THE SKELETON AND MUSCLES OF THE DORSAL FIN OF *SEBASTES JORDANI* AND *SEBASTES NEBULOSUS* (SCORPAENIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):92-101. 1979. SFA 26(1)
[GosNIORKh, Leningrad, USSR]

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[Univ. Ill. Med. Cent., Univ. Chicago, Chicago]

81-000126 Sidon, E. W.; W. D. Peek; J. H. Youson and M. M. Fisher. FINE STRUCTURE OF THE LIVER IN THE LARVAL LAMPREY, *PETROMYZON MARINUS* L.; BILE DUCTS AND GALL BLADDER. *J. Anat.* 131(3):499-517. Oct. 1980. SFA 26(1)
[J. H. Youson: Dep. Zool., Scarborough Coll., Univ. Toronto, West Hill, ON M1C 1A4, Canada]

81-000127 Stefan, Y. and S. Falkmer. IDENTIFICATION OF FOUR ENDOCRINE CELL TYPES IN THE PANCREAS OF COTTUS SCORPIUS (TELEOSTEI) BY IMMUNOFLUORESCENCE AND ELECTRON MICROSCOPY. *Gen. Comp. Endocrinol.* 42(2):171-178. Oct. 1980. SFA 26(1)
[Inst. Histol. Embryol., Univ. Geneva Med. Sch., 1211 Geneva 4, Switzerland]

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[Univ. South. Calif., Los Angeles]

81-000129 Stott, F. C. A NOTE ON THE SPACIOUSNESS OF THE CAVITY AROUND THE BRAIN OF THE BASKING SHARK, *CETORHINUS MAXIMUS* (GUNNER). *J. Fish Biol.* 16(6):665-667. June 1980. SFA 26(1)
[Back of Beyond, Winter Hill, Cookham Dean, Berkshire, England] A description, including measurements, is given of the brain and cranial cavity of the basking shark, *Cetorhinus maximus*. The significance of the small brain and its enclosure by a relatively large cranial cavity in a thick cartilagenous skull is discussed.

81-000130 Tedman, R. A. COMPARATIVE STUDY OF THE CRANIAL MORPHOLOGY OF THE LABRIDS *CHOERODON VENUSTUS* AND *LABROIDES DIMIDIATUS* AND THE SCARID *SCARUS FASCIATUS* (PISCES: PERCIFORMES). I. HEAD SKELETON. *Aust. J. Mar. Freshwater Res.* 31(3):337-349. June 1980. SFA 26(1)
[Dep. Anat., Univ. Queensland, St. Lucia, Queensland, 4067, Australia]

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[Inst. Physiol., Univ. Bergen Årstodveien 19, PKI, N-5000 Bergen, Norway]

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[Dep. Zool., Univ. Toronto, Toronto, ON M5S 1A1, Canada] Capture of muskellunge by angling resulted in a reduction of blood pH, elevated lactic acid concentrations, and a drop in total carbon dioxide and bicarbonate concentrations. The acidaemia was most severe immediately after capture and began to decline well before the blood lactate levels rose. Blood lactate levels were not as high as those characterizing fatigue in most other species. Recovery from the acidosis required 12 to 18 h and was accompanied by declines of 22% and 40% in haemoglobin and haematocrit levels respectively. With the exception of dying fish, there were only slight fluctuations in plasma sodium and potassium levels during recovery, indicating that there was no severe ionoregulatory dysfunction. Thirty per cent of all angled muskellunge died. The last stages immediately preceding death were characterized by declining blood pH and elevated potassium levels.

81-000151 Besner, M. ENDURANCE TRAINING: AN AFFORDABLE REARING STRATEGY TO INCREASE FOOD CONVERSION EFFICIENCY, STAMINA, GROWTH AND SURVIVAL OF COHO SALMON SMOLTS (*ONCORHYNCHUS KISUTCH*). *Ph.D. dissertation, Univ. Wash.* 213p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1662. Nov. 1980. SFA 26(1)

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The upper incipient lethal temperature of rainbow trout reared at 10°C fell between 24 and 25°C. The size ranges of fish used in the four experiments did not alter these results. Rainbow trout, subjected to ten rates of daily increases in water temperature, tolerated water temperatures up to and including 26°C, an increase of 1 to 2°C above that of the upper incipient lethal temperature. The size of the fish used in these experiments did not alter the results. The highest recorded, surface water temperature in several Alberta stocked pothole lakes was below the lethal temperature of rainbow trout of the size ranges used in these experiments. The tolerance of rainbow trout to the synergistic effect of both water temperature and water chemistry present in these pothole fisheries warrants further investigation.

81-000153 Bidgood, B. F. TOLERANCE OF RAINBOW TROUT TO DIRECT CHANGES IN WATER TEMPERATURE. *Alberta Dep. Energy Nat. Resour. Fish. Res. Rep.* No. 15. Mar. 1980. SFA 26(1)

Rainbow trout reared at 10°C, placed in 1°C water for periods of 2, 4, 6, 8 and 10 hours, and then placed in 15°C water for 4 days did not exhibit any mortality. Test fish reared at 10°C, placed in 1°C water for the above five exposure periods, and then placed in a final water temperature of 20°C for 4 days, did not die. The size of the test fish used in this experiment did not alter the results.

81-000154 Bieniarz, K.; P. Epler; B. Malczewski and T. Passakas. DEVELOPMENT OF EUROPEAN EEL (*ANGUILLA ANGUILLA L.*) GONADS IN ARTIFICAL CONDITIONS. *Aquaculture* 22(1-2):53-66. Jan. 1981. SFA 26(1)

[Agric. Acad., Inst. Appl. Zool., Al. Mickiewicza 24/28, Krakow, Poland] Gonadal development was investigated in 58 European eels of known age kept in aquaria in stable conditions optimal for growth (except for light). Sex of fish was determined by histological analyses of gonads, the results of which were checked by kariological analysis. It was found that: 1)Sex differentiation in European eels is connected with size of fish and not age and begins when eels reach 10 cm in length. 2)Gonads of the European eel do not pass through a stage of juvenile hermaphroditism.

81-000155 Boge, G.; A. Rigal and G. Peres. EFFECT OF ENVIRONMENTAL OXYGEN TENSIONS ON *IN VIVO* INTESTINAL ABSORPTION OF GLYCINE BY THE RAINBOW TROUT (*SALMO GAIRDNERI* R.). *Comp. Biochem. Physiol. A Comp. Physiol.* 67(4):679-682. 1980. SFA 26(1)

[Lab. Marit. Physiol., Inst. Michel Pacha 83500, Tamaris sur mer, France]

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[Area Fish. Off., Severn-Trent Water Auth., Meadow Lane, Nottingham NG2 3HN, England] First year roach from a stillwater habitat were maintained in an artificial stream for periods of up to 40 days and samples of the lateral musculature were subjected to histological examination. It was found that there was a highly significant increase in the percentage of red muscle present in the hindermost regions of the fish confined to 30 days or more in the stream. In subsequent exercise tests, it was shown that the FV_{50} was higher for fish conditioned for 40 days, but it was considered unlikely that this increase in swimming ability was as a direct result of changes in muscle composition.

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[I. P. Pavlov Inst. Physiol., Acad. Sci. USSR, Leningrad, USSR]

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[Appl. Physics Lab., Johns Hopkins Univ., 4800 Atwell Rd., Shady Side, MD 20867]

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[Lab. Human Reprod. Reprod. Biol., Harvard Med. Sch., 45 Shattuck St., Boston, MA 02115]

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[Inst. Invest. Pesq., Torre La Sal, Castellón, Spain]

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[Dep. Fish. Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9K 5K6, Canada] Of the three environmental factors investigated, temperature had the strongest influence on growth of sockeye, coho, and fall chinook fry (starting weights 0.7, 0.7, and 1.2g, respectively). Growth of coho was significantly greater under a changing photoperiod than under a constant 12h photoperiod, whereas the chinook fry showed no consistent growth response to the photoperiod treatments. Hypo-osmoregulatory ability of juvenile coho in sea water was influenced by photoperiod, but none of the photoperiod treatments produced optimum osmoregulatory performance. Salinities up to 20 °/oo had little effect on growth rate in coho, sockeye, or chinook, but did prevent loss of hypo-osmoregulatory ability in the latter species at 15°C. Transfer to 29 °/oo during the second half of the 12-week experiment resulted in slower growth of sockeye and chinook smolts.

81-000172 Clarke, W. C. and J. E. Shelbourn. OPTIMUM CONDITIONS FOR SMOLTING IN UNDERYEARLING COHO SALMON. *Am. Zool.* 20(4):873. 1980. Abstract only. SFA 26(1)
[Pac. Biol. Stn., Nanaimo, BC, Canada] Coho fry were reared in 197 liter tanks at temperatures of 8° to 18°C for 20 weeks from first feeding. Simulated natural photoperiod was compared with 3 artificial photoperiods in an attempt to advance the time of smolting. Samples of 10 - 12 fish were removed from each tank periodically and transferred to sea water to determine the rate of development of hypo-osmoregulatory ability as a measure of smolting. All 3 artificial photoperiods suppressed smolting in comparison with natural photoperiod. The suppression was greatest on a constant 17h regime. Results from the 2 dynamic artificial photoperiods indicated that compression of the annual photoperiod cycle by advancing the solstice while maintaining a normal rate of change of daylength is more stimulatory than is an acceleration of the rate of change of daylength. Under natural photoperiod, the optimal temperature for smolting was 14.5°C; maximal hypo-osmoregulatory ability was attained at the time of the summer solstice.

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[Univ. Ga., Athens]

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[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

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[Dep. Gen. Biol., Med. Acad., 15-230 Bialystock, Poland]

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[Univ. Wash., Seattle]

81-000179 Davis, K. B.; N. C. Parker and P. Torrance. GROWTH, BODY COMPOSITION AND LIVER TYROSINE AMINOTRANFERASE IN CHANNEL CATFISH FED CORTISOL IN THE DIET. *Am. Zool.* 20(4):833. 1980. Abstract only. SFA 26(1)
[Memphis State Univ., Memphis, TN] The metabolic consequences of chronic elevation of cortisol in the diet was studied in yearling channel catfish, *Ictalurus punctatus*. Cortisol was incorporated into the diet in concentrations of 1, 10, 50, and 100 mg/kg of food which was fed at 3% of the body weight per day. Feeding rates were adjusted at 2 wk intervals when fish were individually measured (standard length) and weighed. After 10 wk fish fed diets with 50 and 100 mg of cortisol per kg of food had lower condition factors, lower body weights and higher feed conversion ratios than fish fed diets with lower levels of cortisol. Liposomatic and hepatosomatic indices were significantly lower in fish fed 100 mg cortisol per kg of food. Liver tyrosine aminotransferase specific activity was significantly higher at the higher cortisol doses. Long term cortisol administration can reduce growth and the condition factor of channel catfish by gluconeogenic activity on fat stores and amino acid degradation.

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[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

81-000182 Delahunty, G.; J. Olcese and V. de Vlaming. PHOTOPERIOD EFFECTS ON CARBOHYDRATE METABOLITES IN THE GOLDFISH, *CARASSIUS AURATUS*: ROLE OF THE PINEAL AND RETINAL PATHWAYS. *Rev. Can. Biol.* 39(3):173-180. Sept. 1980. In English with French summ. SFA 26(1)
[V. de Vlaming: Biol. Dep., Marquette Univ., Milwaukee, WI 53233]

81-000183 deRoos, C. C. and R. deRoos. PLASMA GLUCOSE LEVELS INCREASE AFTER PARTIAL HYPOPHYSECTOMY (ACTH REMOVAL) AND SHAM SURGERY IN THE SPINY DOGFISH SHARK (*SQUALUS ACANTHIAS*). *Gen. Comp. Endocrinol.* 42(2):270-273. Oct. 1980. SFA 26(1)
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81-000184 Dickhoff, W. W.; J. Y. L. Yu; R. T. Turner and A. Gorbman. STEROID REGULATUON OF VITELLOGENESIS IN PACIFIC HAGFISH. *Am. Zool.* 20(4):730. 1980. Abstract only. SFA 26(1)
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[Sch. Life Health Sci., Univ. Del., Newark 19711]

81-000186 Eales, J. G.; G. Van der Kraak and J. P. Chang. EFFECTS OF TEMPERATURE ON THE PLASMA LEVELS, PLASMA KINETICS AND NUCLEAR BINDING OF THYROID HORMONES IN RAINBOW TROUT. *Am. Zool.* 20(4):857. 1980. Abstract only. SFA 26(1)

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[Dep. Pathol., Univ. Umeå, S-901 87 Umeå 6, Sweden]

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[Dep. Fish. Oceans, Resour. Br., Halifax, NS B3J 2S7, Canada]

81-000190 Fenwick, J. C. and E. K. S. Leung. EFFECT OF CALCITONIN ON UPTAKE, DISTRIBUTION AND CLEARANCE OF RADIOCALCIUM IN EELS. *Am. Zool.* 20(4):897. 1980. Abstract only. SFA 26(1)
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[Dep. Anat., Univ. Colo. Med. Cent., Denver 80262] Pathways conveying lateral-line sensory information within the brain of a bullhead catfish terminate in a localized zone within the telencephalon. Thus, the telecephalon in teleosts, as in amniote species, contains regions that receive specific sensory input. Therefore, this lemniscal organization is not restricted to mammalian or amniote species but is a feature common to most, if not all, vertebrates.

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[U.C.N.W. Mar. Sci. Lab., Menai Bridge, Anglesey, Gwynedd, Wales]

81-000193 Follénius, E.; G. Schmitt and A. Meunier. L'HORMONE MÉLANOTROPE DU POISSON ROUGE (*CARASSIUS AURATUS* L.): COMPARAISON RADIO-IMMUNOLOGIQUE AVEC L'α MSH DE SYNTHÈSE. [STUDY OF THE IMMUNOLOGICAL RELATEDNESS OF GOLDFISH MSH IN AN RIA FOR SYNTHETIC MAMMALIAN αMSH.] *C.R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 291(3):337-340. 22 Sept. 1980. In French with English summ. SFA 26(1)
[Lab. Cytol. Anim. E.R.A. 492 C.N.R.S., 12 rue de l'Universite, 67000 Strasbourg, France]

81-000194 Forster, R. P. and J. A. Hannafin. TAURINE UPTAKE IN ATRIAL MYOCARDIUM BY A SODIUM-DEPENDENT β-AMINO ACID SYSTEM IN THE ELASMOBRANCH, *RAJA ERINACEA*. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 67(2):107-113. 1980. SFA 26(1)
[Dep. Biol. Sci., Hanover, NH 03755]

81-000195 Fugelli, K. and H. Rohrs. THE EFFECT OF Na^+ AND OSMOLALITY ON THE INFLUX AND STEADY STATE DISTRIBUTION OF TAURINE AND GAMMA-AMINOBUTYRIC ACID IN FLOUNDER (*PLATICHTHYS FLESUS*) ERYTHROCYTES. *Comp. Biochem. Physiol. A Comp. Physiol.* 67(4):545-551. 1980. SFA 26(1)
[Inst. Zoophysiol., Univ. Oslo, P.B. 1051, Blindern, Oslo 3, Norway]

81-000196 Gerking, S. D. and R. M. Lee. REPRODUCTIVE PERFORMANCE OF THE DESERT PUPFISH (*CYPRINODON N. NEVADENSIS*) IN RELATION TO SALINITY. *Environ. Biol. Fishes* 5(4):375-378. 8 Dec. 1980. SFA 26(1)
[Dep. Zool., Ariz. State Univ., Tempe 85281] The reproductive performance of the desert pupfish, *Cyprinodon n. nevadensis*, was tested by exposing breeding pairs to a range of salinities from 0.1 to over 40°/oo. In terms of eggs/g body weight/day, eggs per spawning and embryo viability, reproductive performance was optimal at 10°/oo. Performance decreased above and below 11°/oo, producing a plateau of statistically equivalent reproductive performance from 0.2 to 20°/oo. The upper salinity limit placed on reproduction is the tolerance of the eggs, since a few eggs are laid above 20°/oo but they do not hatch. These small fish probably never experience the upper salinity limit for reproduction in their native habitat. The tolerance limits for reproduction are compared with a lethal range from less than 0.1 to 53°/oo in a 96 h LD-50 test.

81-000197 Gillerman, R. G. CHARACTERIZATION OF SWIMMING MUSCLE IN THE ATLANTIC MACKEREL, *SCOMBER SCOMBRUS* L. *J. Fish Biol.* 17(1):31-41. July 1980. SFA 26(1)
[Dep. Zool., Univ. Mass., Amherst]

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81-000198 Goetz, F. W. PROSTAGLANDIN LEVELS DURING STEROID-INDUCED *IN VITRO* FINAL MATURATION OF BROOK TROUT (*SALVELINUS FONTINALIS*) OOCYTES. *Am. Zool.* 20(4):730. 1980. Abstract only. SFA 26(1)
[Univ. Notre Dame, Notre Dame, IN]

81-000199 Gorbman, A. EVOLUTION OF THE BRAIN-PITUITARY RELATIONSHIP: EVIDENCE FROM THE AGNATHA. *Can. J. Fish. Aquatic Sci.* 37(11):1680-1686. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Zool., Univ. Wash., Seattle 98195]

81-000200 Grau, E. G.; R. S. Nishioka and H. A. Bern. EFFECTS OF SEAWATER (SW) ENTRY ON THYROID FUNCTION IN THE COHO SALMON, *ONCORHYNCHUS KISUTCH*. *Am. Zool.* 20(4):857. 1980. Abstract only. SFA 26(1)
[Univ. Calif., Berkeley]

81-000201 Grove, B. D. and J. D. McPhail. AN ANALYSIS OF INTRAOVARIAN SPERM INTERACTIONS IN *POECILIA RETICULATA*. *Am. Zool.* 20(4):876. 1980. Abstract only. SFA 26(1)
[Clemson Univ., Clemson, SC]

81-000202 Guest, W. C.; B. W. Lyons and G. Garza. EFFECTS OF TEMPERATURE ON SURVIVAL OF PEACOCK BASS FINGERLINGS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:620-627. 1979(1980). SFA 26(1)
[Heart of the Hills Res. Stn., Tex. Parks Wildl. Dep., Junction Star Rt., Box 62, Ingram 78025] Effects of temperature on survival of peacock bass (*Cichla ocellaris*) fingerlings were examined in the laboratory. Fish were acclimated to 25, 30 or 35 C prior to testing. The ultimate lower and upper lethal temperatures in freshwater were 15.6 and 37.9 C when the temperature change from acclimation was 1 C/day. Salinity (10^{0}/oo) significantly reduced ($P<0.05$) the ultimate lower lethal temperature of 14.4 C. Acclimation temperature significantly affected the temperature at which peacock bass began losing equilibrium (LE_{50}) and dying (CTMin) when fish were exposed to a 1 C/h decrease. LE_{50}'s for the 35, 30 and 25 C acclimation temperatures were 18.9, 16.2 and 14.5 C, respectively. When fish were transferred abruptly from acclimation to 20, 15 and 10 C, median resistnace times were longer when there was less difference between acclimation and test temperatures.

81-000203 Halpern, L. R.; M. P. Schreibman and H. Margolis-Kazan. LOCALIZATION OF LUTEINIZING HORMONE-RELEASING HORMONE IN HYPOPHYSECTOMIZED PLATYFISH. *Am. Zool.* 20(4):728. 1980. Abstract only. SFA 26(1)
[Dep. Biol., Brooklyn Coll., NY 11210]

81-000204 Hanson, C. H. ENERGETIC CONSIDERATIONS IN VELOCITY PREFERENCE AND SWIMMING SPEED SELECTION OF JUVENILE FISHES. *Ph.D. dissertation, Univ. Calif. (Davis)* 104p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(6):2044. Dec. 1980. SFA 26(1)
A bioenergetic approach, based on the relationship between swimming speed and respiratory rate, was examined as a method for predicting behaviorally selected swimming speeds of juvenile fishes. Energetically optimal swimming speeds were determined for juvenile chinook salmon (*Oncorhynchus tshawytscha*), bluegill (*Lepomis macrochirus*), Mississippi silversides (*Menidia audens*). General agreement between the predicted optimal swimming speed and behaviorally selected swimming speed for fish within a laboratory hydraulic gradient supports the hypothesis that juvenile fish behaviorally select a swimming speed which is energetically optimal.

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81-000205 Hayashi, K. and T. Takagi. COMPOSITION OF DIACYL GLYCERYL ETHERS IN THE LIVER LIPIDS OF RATFISH, *HYDROLAGUS NOVAEZEALANDIAE*. *Bull. Jpn. Soc. Sci. Fish.* 46(7):855-861. July 1980. SFA 26(1)
[Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

81-000206 Hayashi, K. and T. Takagi. OCCURRENCE OF NEUTRAL PLASMALOGENS IN THE LIVER LIPIDS OF RATFISH, *HYDROLAGUS NOVAEZEALANDIAE*. *Bull. Jpn. Soc. Sci. Fish.* 46(8):1043-1049. Aug. 1980. SFA 26(1)
[Fac. Fish., Hokkaido Univ., Hokodate 041, Japan]

81-000207 Heath, A. G.; D. T. Burton and M. J. Smith. ANAEROBIC METABOLISM IN FISHES: ENVIRONMENTAL THRESHOLDS AND TIME DEPENDENCE. *Rev. Can. Biol.* 39(2):123-128. June 1980. SFA 26(1)
[Dep. Biol., VPI&SU, Blacksburg, VA 24061]

81-000208 Heiligenberg, W. THE JAMMING AVOIDANCE RESPONSE IN THE WEAKLY ELECTRIC FISH *EIGENMANNIA*. A BEHAVIOR CONTROLLED BY DISTRIBUTED EVALUATION OF ELECTRORECEPTIVE AFFERENCES. *Naturwissenschaften* 67(1):499-507 Oct. 1980. SFA 26(1)
[Neurobiol. Unit, Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093]

81-000209 Hilge, V. LONGTERM OBSERVATION ON BLOOD PARAMETERS OF ADULT MIRROR CARP (*CYPRINUS CARPIO* L.) HELD IN A CLOSED WARM WATER SYSTEM. *Arch. Fischereiwiss.* 31(1):41-50. July 1980. In English with German summ. SFA 26(1)
[Inst. Küsten-Binnenfisch., Bundesforsch. Fisch., Hamburg, West Germany]

81-000210 Hinuma, S.; T. Abo; K. Kumagai and M. Hata. THE POTENT ACTIVITY OF FRESHWATER FISH KIDNEY CELLS IN CELL-KILLING. I. CHARACTERIZATION AND SPECIES-DISTRIBUTION OF CYTOTOXICITY. *Dev. Comp. Immunol.* 4(4):653-666. 1980. SFA 26(1)
[K. Kumagai: Dep. Microbiol., Tohoku Univ. Sch. Dent., Sendai, Japan]

81-000211 Hobe, H.; P. R. H. Wilkes; R. L. Walker; C. M. Wood and B. R. McMahon. EFFECTS OF LOW pH ON THE PHYSIOLOGY OF THE BENTHIC CYPRINID, *CATOSTOMUS COMMERSONI*. *Am. Zool.* 20(4):835. 1980. Abstract only. SFA 26(1)
[Univ. Calgary, Calgary, AB, Canada] Chronically catheterized white suckers (250-800g) were maintained at pH 4-4.5 (H_2SO_4) for 4 days in an aerated recirculating water system (12.5±1 C). Blood acid-base status (pH, total carbon dioxide content) and plasma ion levels (Na+, K+, Cl-, Ca++, Mg++) were monitored. During acid exposure, a major blood acidosis developed, as evidenced by significant depressions of blood pH and plasma bicarbonate and simultaneous elevation of blood P_{CO_2}. These data suggest that the acidosis is of both metabolic and respiratory origin. The effect of acid stress on plasma ion levels was less marked. While no significant changes in Ca++ and Mg++ levels occurred, Cl- and Na+ levels progressively declined and K+ levels increased. The overall pattern of ionic disturbance was reflected in plasma osmolality which significantly decreased over the acid exposure period. Experiments are currently in progress examining renal electrolyte and acid excretion in white suckers at low pH. Interrelationships between gill and kidney function during acid exposure will also be discussed.

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81-000212 Holmquist, A.; S. Stohlman; M. Trousdale; R. Ganges and P. Meyer. CHARACTERIZATION OF PERITONEAL MACROPHAGES FROM TWO MARINE FISHES. *Am. Zool.* 20(4):795. 1980. Abstract only. SFA 26(1)
[Chevron Oil Field Res. Co., La Habra, CA]

81-000213 Hontela, A. and R. E. Peter. SYNCHRONISATION OF DAILY GONADOTROPIN CYCLES WITH TEMPERATURE, FEEDING AND LIGHT IN THE GOLDFISH. *Am. Zool.* 20(4):728. 1980. Abstract only. SFA 26(1)
[Univ. Alberta, Edmonton, AB, Canada]

81-000214 Hughes, G. M.; C. Peyraud; M. Peyraud-Waitzenegger and P. Soulier. PROPORTION OF CARDIAC OUTPUT CONCERNED WITH GAS EXCHANGE IN GILLS OF THE EEL (*A. ANGUILLA*). *J. Physiol. (Lond.)* 310:61P-62P. Jan. 1981. SFA 26(1)
[Res. Unit Comp. Anim. Respir., Bristol Univ., U.K.]

81-000215 Hurk, R. van den and C. J. J. Richter. HISTOCHEMICAL EVIDENCE FOR GRANULOSA STEROIDS IN FOLLICLE MATURATION IN THE AFRICAN CATFISH, *CLARIAS LAZERA*. *Cell Tissue Res.* 211(2):345-348. Oct. 1980. SFA 26(1)
[Zool. Lab., Sect. Comp. Endocrinol., Utrecht, The Netherlands]

81-000216 Idler, D. R. and K. M. Kane. CYTOSOL RECEPTOR GLYCOPROTEIN FOR 1α-HYDROXYCORTICOSTERONE IN TISSUES OF AN ELASMOBRANCH FISH (*RAJA OCELLATA*). *Gen. Comp. Endocrinol.* 42(2):259-266. Oct. 1980. SFA 26(1)
[Mar. Sci. Res. Lab., Memorial Univ., St. John's, NF A1C 5S7, Canada]

81-000217 Ingermann, R. L. and R. C. Terwilliger. ROOT EFFECT HEMOGLOBINS IN FISHES LACKING A FUNCTIONAL SWIM BLADDER. *Am. Zool.* 20(4):767. 1980. Abstract only. SFA 26(1)
[Oreg. Inst. Mar. Biol., Univ. Oreg., Charleston]

81-000218 Ingermann, R. L. THE MOLECULAR BASIS OF A MATERNAL-FETAL OXYGEN SHIFT IN THE VIVIPAROUS SEAPERCH, *EMBIOTOCA LATERALIS*. *Ph.D. dissertation, Univ. Oreg.* 166p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1611. Nov. 1980. SFA 26(1)

81-000219 Jensen, A. J. THE 'GUT INDEX', A NEW PARAMETER TO MEASURE THE GROSS NUTRITIONAL STATE OF ARCTIC CHAR, *SALVELINUS ALPINUS* (L.) AND BROWN TROUT, *SALMO TRUTTA* L. *J. Fish Biol.* 17(6):741-747. Dec. 1980. SFA 26(1)
[Dir. Wildl. Freshwater Fish, Elgesetergt. 10, N-7000 Trondheim, Norway]
The main energy reserves in brown trout, *Salmo trutta* and Arctic char, *Salvelinus alpinus* are located in the abdominal cavity and the musculature. The energy content of the rest of the intestines after removal of the gonads, swim bladder, and liver is a good parameter to assess the gross nutritional state of Arctic char and brown trout. This method is laborious, but analysing the dry matter fraction (or the water content) of the same organs instead of their energy content is a practical alternative. The dry matter fraction of these organs expressed as a percentage of its wet weight is here called the 'Gut index'.

81-000220 Jobling, M. and P. Spencer Davies. EFFECTS OF FEEDING ON METABOLIC RATE, AND THE SPECIFIC DYNAMIC ACTION IN PLAICE, *PLEURONECTES PLATESSA* L. *J. Fish Biol.* 16(6):629-638. June 1980. SFA 26(1)

PHYSIOLOGY (CONTINUED)

81-000220 CONTINUED
[Inst. Fisker., Univ. Tromsø, Tromsø, Norway] The rate of oxygen consumption of plaice increases after feeding and declines to a resting level after 24-72 h. The maximum increase corresponds to a level which is approximately twice the resting rate of oxygen consumption. This increase corresponds to the Specific Dynamic Action (SDA) and increases in magnitude with increase in food intake. The magnitude is greatest with high protein content diets. The duration of the SDA effect is reduced with increase in temperature and increases with the percentage of protein in the diet.

81-000221 Jobling, M. EFFECTS OF STARVATION ON PROXIMATE CHEMICAL COMPOSITION AND ENERGY UTILIZATION OF PLAICE, *PLEURONECTES PLATESSA* L. *J. Fish Biol.* 17(3):325-334. Sept. 1980. SFA 26(1)
[Inst. Fisher., Univ. Tromsø, 9001 Tromsø, Norway] Proximate analysis of the body tissues of plaice showed that body fat was the major storage reserve utilized during starvation. Although the liver and gut were mush depleted during the period of the fast they contributed only a small portion of the metabolizable energy. Atrophy of the gut led to reductions in motor activity but the ability to digest and absorb nutrients was not impaired. Assessments of energy utilization using proximate analysis and calculations from ammonia quotient determinations are compared and show that during the latter part of the fast 20-25% of the energy utilized was derived from protein catabolism.

81-000222 Jobling, M. GASTRIC EVACUATION IN PLAICE, *PLEURONECTES PLATESSA* L.: EFFECTS OF TEMPERATURE AND FISH SIZE. *J. Fish Biol.* 17(5):547-551. Nov. 1980. SFA 26(1)
[Inst. Fiskeri., Univ. Tromsø, 9001, Tromsø, Norway] Using a volume dependent model of gastric evacuation, the effects of temperature and fish size were examined. Rates of gastric evacuation were unaffected by the fish size but increased with increasing temperature. The relationship between maximum stomach volume and fish weight was found to be a linear one. From information of gastric evacuation rates and stomach volume, the amount of food evacuated from the stomach per day was calculated for different size classes of fish. Daily food evacuation increased in proportion to body weight to the power 0.68. Assuming these methods give a crude estimate of daily food intake, the results are discussed in relation to published work on food intake in fishes.

81-000223 Jobling, M. GASTRIC EVACUATION IN PLAICE, *PLEURONECTES PLASTESSA* L.: EFFECTS OF DIETARY ENERGY LEVEL AND FOOD COMPOSITION. *J. Fish Biol.* 17(2):187-196. Aug. 1980. SFA 26(1)
[Inst. Fisher., Univ. Tromsø, 9001 Tromsø, Norway] Using a volume dependent model of evacuation, the effects of dietary energy level and source upon gastric emptying were examined. Diets containing small amounts of energy were evacuated from the stomach more rapidly than those with a higher energy content. When the data is examined with respect to the evacuation of energy from the stomach and is plotted as $\sqrt{\text{Energy}} = c_e - m_e$ Time; the rate of evacuation of (m_e) is seen to be independent of energy level and the composition of the diet.

81-000224 Johnston, I. A. and B. Maitland. TEMPERATURE ACCLIMATION IN CRUCIAN CARP, *CARASSIUS CARASSIUS* L., MORPHOMETRIC ANALYSES OF MUSCLE FIBRE ULTRASTRUCTURE. *J. Fish Biol.* 17(1):113-125. July 1980. SFA 26(1)
[Dep. Physiol., Univ. St. Andrews, St. Andrews, Fife, Scotland]

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81-000225 Johnstone, A. D. F. and A. D. Hawkins. CHANGES IN THE RESPIRATION AND BLOOD CIRCULATION OF COD, *GADUS MORHUA* L., INDUCED BY EXPOSURE TO POLLUTANTS. *Scott. Fish. Res. Rep.* No. 18. 18p. 1980. SFA 26(1)
[Mar. Lab., Aberdeen, Scotland]

81-000226 Kagawa, H. and Y. Nagahama. ULTRASTRUCTURAL LOCALIZATION OF Δ^5-3β-HYDROXYSTEROID DEHYDROGENASE IN THE INTERRENAL CELLS OF THE GOLDFISH (*CARASSIUS AURATUS*). *Cell Tissue Res.* 212(2):225-231. Nov. 1980. SFA 26(1)
[Y. Nagahama: Lab. Reprod. Biol., Natl. Inst. Basic Biol., Okazaki, Japan 444]

81-000227 Kawamura, T. and T. Tamura. RESPONSES OF THE CARP PIT ORGAN TO CHEMICAL AND THERMAL STIMULI. *Bull. Jpn. Soc. Sci. Fish.* 46(7):819-830. July 1980. SFA 26(1)
[Fish. Lab., Fac. Agric., Nagoya Univ., Nagoya 464, Japan]

81-000228 Kemp, N. E. SECRETION OF AMELOBLASTIC VESICLES AND POLYMERIZATION OF ENAMELIN IN TEETH OF THE LEMON SHARK *NEGAPRION BREVIROSTRIS*. *Am. Zool.* 20(4):911. 1980. Abstract only. SFA 26(1)
[Univ. Mich., Ann Arbor]

81-000229 Kilambi, R. V. FOOD CONSUMPTION, GROWTH AND SURVIVAL OF GRASS CARP *CTENOPHARYNGODON IDELLA* VAL AT FOUR SALINITIES. *J. Fish Biol.* 17(6):613-618. Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Ark., Fayetteville 72701] Grass carp were raised in 227-l indoor tanks at 3,5,7 and 9°/oo salinities and 18·5 and 29·5°C temperatures at a density of five fish per tank. Growth rate did not differ under these conditions. Food consumption was similar between temperatures at a given salinity but differed among the salinities with most food intake at the 5°/oo salinity. An average of 40% of grass carp survived for 180 or more days.

81-000230 Kim, Ye. D. THE VARIABILITY OF PHOSPHOLIPIDS AND CHOLESTEROL IN THE EARLY ONTOGENY OF THE GRASS CARP, *CTENOPHARYNOGODON IDELLA*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):163-166. 1979. SFA 26(1)
[Inst. Hydrobiol., Ukrainian SSR Acad. Sci., Kiev, USSR]

81-000231 Kime, D. E. and D. N. Saksena. THE EFFECT OF TEMPERATURE ON THE HEPATIC CATABOLISM OF TESTOSTERONE IN THE RAINBOW TROUT (*SALMO GAIRDNERI*) AND THE GOLDFISH (*CARASSIUS AURATUS*). *Gen. Comp. Endocrinol.* 42(2):228-234. Oct. 1980. SFA 26(1)
[Dep. Zool., The University, Sheffield S10 2TN, England]

81-000232 Kitchell, J. F. and J. E. Breck. BIOENERGETICS MODEL AND FORAGING HYPOTHESIS FOR SEA LAMPREY (*PETROMYZON MARINUS*). *Can. J. Fish Aquatic Sci.* 37(11):2159-2168. Nov. 1980. In English with French summ. SFA 26(1)
[Lab. Limnol., Univ. Wis., Madison 53706]

81-000233 Kramer, D. L. and M. McClure. AERIAL RESPIRATION IN THE CATFISH, *CORYDORAS AENEUS* (CALLICHTHYIDAE). *Can. J. Zool.* 58(11):1984-1991. Nov. 1980. In English with French summ. SFA 26(1)

PHYSIOLOGY (CONTINUED)

81-000233 CONTINUED
[Dep. Biol., McGill Univ., 1205 Ave. Dr. Penfield, Montreal, PQ H3A 1B1, Canada]

81-000234 Kramer, D. L. A COMPARATIVE TEST OF THE ADAPTIVE SIGNIFICANCE OF AQUATIC SURFACE RESPIRATION IN FISHES. *Am. Zool.* 20(4):742. 1980. Abstract only. SFA 26(1)
[McGill Univ., Montreal, PQ, Canada]

81-000235 Kus'mina, V. V. THE DISTRIBUTION OF α-AMYLASE ACTIVITY ALONG THE GUT IN FRESHWATER TELEOSTS. *J. Ichthyol. (Engl. Transl. Vopr. (khtiol.)* 19(4):107-117. 1979. SFA 26(1)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl' Reg., USSR] Data are given on the distribution of α-amylase activity along the gut in 12 species of freshwater teleosts of different ecological groups. It is shown that the nature of the proximal-distal gradient of enzyme activity (PDG) does not depend on the level of activity of the enzyme and varies greatly; maximum activity can be observed not only in the proximal and medial, but also in the distal section of the gut. This also applies to α-amylase connected with extra-cellular digestion, and to enzymes carrying out membrane hydrolysis of carbohydrates. A dependence between PDG and the method of calculating enzyme activity is revealed.

81-000236 Lacroix, G. L. THE REPRODUCTIVE ENVIRONMENT OF LANDLOCKED ATLANTIC SALMON (*SALMO SALAR* L.). *Ph.D. dissertation, Univ. New Brunswick (Canada)* 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1613. Nov. 1980. SFA 26(1)

81-000237 Lai, K. V.; E. G. Grau; R. S. Nishioka and H. A. Bern. INFLUENCE OF TSH UPON STRUCTURE OF THYROID GLAND IN COHO SALMON. *Am. Zool.* 20(4):857. 1980. Abstract only. SFA 26(1)
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81-000238 Lanctin, H. P.; L. E. McMorran and W. R. Driedzic. RATES OF GLUCOSE AND LACTATE OXIDATION BY THE PERFUSED ISOLATED TROUT (*SALVELINUS FONTINALIS*) HEART. *Can. J. Zool.* 58(9):1708-1711. Sept. 1980. In English with French summ. SFA 26(1)
[Dep. Biol., Mount Allison Univ., Sackville, NB E0A 3C0, Canada]

81-000239 Lane, H. C. and T. P. Tharp. CHANGES IN THE POPULATION OF POLYRIBOSOMAL CONTAINING RED CELLS OF PERIPHERAL BLOOD OF RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON, FOLLOWING STARVATION AND BLEEDING. *J. Fish Biol.* 17(1):75-81. July 1980. SFA 26(1)
[Wake Forest Univ., Winston-Salem, NC]

81-000240 Larsen, L. O. PHYSIOLOGY OF ADULT LAMPREYS, WITH SPECIAL REGARD TO NATURAL STARVATION, REPRODUCTION, AND DEATH AFTER SPAWNING. *Can. J. Fish. Aquatic Sci.* 37(11):1762-1779. Nov. 1980. In English with French summ. SFA 26(1)
[August Krogh Inst., Zoophysiol. Lab. A, Univ. Copenhagen, Copenhagen, Denmark]

81-000241 Leach, G. J. and M. H. Taylor. THE ROLE OF CORTISOL IN STRESS-INDUCED METABOLIC CHANGES IN *FUNDULUS HETEROCLITUS*. *Gen. Comp. Endocrinol.* 42(2):219-227. Oct. 1980. SFA 26(1)
[Dep. Physiol., La. State Univ., Sch. Med., New Orleans 70112]

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81-000242 Lee, R. M. and J. N. Rinne. CRITICAL THERMAL MAXIMA OF FIVE TROUT SPECIES IN THE SOUTHWESTERN UNITED STATES. *Trans. Am. Fish. Soc.* 109(6):632-635. Nov. 1980. SFA 26(1)
[Dep. Zool., Univ. Ariz., Tempe 85281]

81-000243 Lewis, S. V. RESPIRATION OF LAMPREYS. *Can. J. Fish. Aquatic Sci.* 37(11):1711-1722. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Zool., Univ. Malaya, Kuala Lumpur, Malaysia]

81-000244 Lidgerding, B. C. CELL CULTURE CONTAMINANTS: A METHOD FOR DETECTION. *Fish Health News* 8(3):i. July 1979. SFA 26(1)
[Natl. Fish Health Res. Lab., Kearneysville, WV 25430]

81-000245 Liem, K. F. LARVAE OF AIR-BREATHING FISHES AS COUNTER-CURRENT FLOW DEVICES IN HYPOXIC ENVIRONMENTS. *Am. Zool.* 20(4):758. 1980. Abstract only. SFA 26(1)
[Mus. Comp. Zool., Harvard Univ., Cambridge, MA]

81-000246 Logan, A. G.; R. Morris and J. C. Rankin. A MICROPUNCTURE STUDY OF KIDNEY FUNCTION IN THE RIVER LAMPREY *LAMPETRA FLUVIATILIS* ADAPTED TO SEA WATER. *J. Exp. Biol. (Cambridge Univ. Press)* 88:239-247. Oct. 1980. SFA 26(1)
[Zool. Dep., Nottingham Univ., England]

81-000247 Loretz, C. A. INITIATION BY CORTISOL OF FISH URINARY BLADDER ELECTROGENIC SODIUM TRANSPORT. *Am. Zool.* 20(4):764. 1980. Abstract only. SFA 26(1)
[Univ. Calif., Berkeley]

81-000248 Maceina, M. J.; F. G. Nordlie and J. V. Shireman. THE INFLUENCE OF SALINITY ON OXYGEN CONSUMPTION AND PLASMA ELECTROLYTES IN GRASS CARP, *CTENOPHARYNGODON IDELLA* Val. *J. Fish Biol.* 16(6):613-619. June 1980. SFA 26(1)
[Aquatic Weeds Res. Cent., Univ. Fla., Gainesville 32611] Fingerling grass carp, *Ctenopharyngodon idella*, 90-160 mm T.L., were acclimated to experimental salinities of <1 (fresh water), 91, 195 and 317 mOsm/kg. Oxygen consumption rates of fish declined, as salinity increased, from 0.16 mg O_2/g-h in fresh water to O_2/g-h at an ambient concentration of 317 mOsm/kg. Plasma electrolites (Na+ and Cl-) and total plasma ionic concentrations increased slightly following 10 days of exposure to ambient salinities greater than 195 mOsm/kg. At 317 mOsm/kg fish appeared to lose control of plasma electrolyte concentrations. As the osmotic gradient was reduced between the fish and the external medium it might have become advantageous to the maintenance of the osmotic equilibrium to reduce blood circulation to the gills, thus imposing reduction in metabolic rate.

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81-000249 Mahajan, C. L. and J. M. S. Dheer. AN AUTORADIORAPHIC AND CYTOCHEMICAL STUDY OF ERYTHROPOIESIS IN A FRESH WATER FISH, *CHANNA PUNCTATUS* BLOCH. *J. Fish Biol.* 17(6):641-648. Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Rajasthan, Jaipur 302004, India] Using spleen and head kidney imprints, studies on erythropoiesis in *Channa punctatus* have been made describing each developmental stage with regard to its morpholgy, morphometry and cytochemistry. This has been undertaken using the new techniques available for haematopoietic studies of fishes. These include autoradiography for information on DNA synthesis and Graham-Knoll's benzidine method with Giemsa used as a counterstain for the differential staining of haemoglobin. Thus, a more definitive picture of the haematopoietic phenomenon in *Channa punctatus* has been evolved.

81-000250 Mahajan, C. L. and J. M. S. Dheer. ORIGIN AND DEVELOPMENT OF NEUTROPHILS IN AN AIR BREATHING FISH, *CHANNA PUNCTATUS* BLOCH. *Acta Zool. (Stockh.)* 61(4):221-224. 1980. SFA 26(1)
[Dep. Zool., Univ. Rajasthan, Jaipur 302004, India]

81-000251 Marrocco, A. DETERMINAZIONE DEL CONSUMO DI OSSIGENO DELLE UOVA DI TROTA IRIDEA (*SALMO GAIRDNERI*). [OXYGEN CONSUPTION BY RAINBOW TROUT EGGS.] *Riv. It. Piscic. Ittiop.* 15(3):86. July-Aug.-Sept. 1980. In Italian with English summ. SFA 26(1)
[Troticolt. Leonardi, 38070 Preore (Trento), Italy]

81-000252 Marshall, W. S. and R. S. Nishioka. RELATION OF MITOCHONDRIA-RICH CHLORIDE CELLS TO ACTIVE CHLORIDE TRANSPORT IN THE SKIN OF A MARINE TELEOST. *J. Exp. Zool.* 214(2):147-156. Nov. 1980. SFA 26(1)
[Dep. Zool., Univ. Calif., Berkeley 94720]

81-000253 Martin, F. D. and R. Malloy. HISTOLOGICAL AND MORPHOMETRIC CRITERIA FOR ASSESSING NUTRITIONAL STATE OF LARVAL STRIPED BASS, *MORONE SAXATILIS*. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 157-166. Sept. 1980. SFA 26(1)
[Univ. Md., Chesapeake Bay Biol. Lab., Solomons 20688] Starvation in the larval stages of striped bass (*Morone saxatilis*) is hypothesized as a major cause of mortality. Establishing criteria for assessing this starvation would aid greatly in predicting year class strength. Larvae were subjected to 5 different feeding regimes for 6 days and samples were preserved during this sequence. Four tissues proved to be sensitive to starvation and a fifth needs to be examined further. These tissues, in sequence of deterioration, are: abdominal body wall, epaxial musculature, gut epithelium, and liver. Retinal tissue may be the most sensitive tissue but further studies are necessary. Morphometric analysis followed by stepwise discriminant analysis found three parameters to be diagnostic. These were head depth, body depth at the pectoral fin, and body depth at the anus divided by head depth. The histological analysis can identify starvation unambiguously. The morphometric analysis is accurate when classifying laboratory reared specimens but further work is needed to relate this to the field.

81-000254 Marusic, E. T.; F. Balbontin; S. M. Galli-Gallardo; M. Garreton; P. K. T. Pang and R. W. Griffith. OSMOTIC ADAPTATIONS OF THE CHILEAN CLINGFISH, *SICYASES SANGUINEUS*, DURING EMERSION. *Comp. Biochem. Physiol. A Comp. Physiol.* 68(1):123-126. 1981. SFA 26(1)
[P. K. T. Pang: Dep. Pharmacol. Therapeutics, Tex. Tech. Univ. Health Sci. Cent., Lubbock 79430] The osmotic adaptations for dehydration of the Chilean

PHYSIOLOGY (CONTINUED)

81-000254 CONTINUED clingfish (*Sicyases sanguineus*) were examined in emerged fish. Plasma osmolarity, electrolyte levels, body weight changes, hematocrit, muscle water content and urea were measured at various times up to 24 hr of emersion. At 24 hr of emersion, the gut surface of the fish was reddish with engorged capillaries. The concomitant presence of air in the gut suggests a role for the intestine in the air breathing mechanism. S. *sanguineus* maintained out of water showed a significant loss of body weight and increases in hematocrit values and plasma osmolarity, urea and electrolyte levels.

81-000255 Massoud, A. A.; Simco, B. A. and K. B. Davis. TWO GONADOTROPHIC CELL-TYPES IN THE PITUITARY OF CHANNEL CATFISH. *Am. Zool.* 20(4):729. Abstract only. SFA 26(1)
[Memphis State Univ., Memphis, TN]

81-000256 Matsuno, T.; M. Katsuyama and S. Nagata. [COMPARATIVE BIOCHEMICAL STUDIES OF CAROTENOIDS IN FISHES--XIX. CAROTENOIDS OF CHUM SALMON COHO SALMON, BIWA TROUT, RED-SPOTTED MASU SALMON, MASU SALMON, AND KOKANEE.] *Bull. Jpn. Soc. Sci. Fish.* 46(7):879-884. July 1980. In Japanese with English summ. SFA 26(1)
[Kyoto Coll. Pharm., Misasagi, Yamashina-ku, Kyoto 607, Japan]

81-000257 Matsuno, T.; S. Nagata and M. Katsuyama. THE STRUCTURE OF A NEW CAROTENOID, SALMOXANTHIN FROM THE SALMON, *ONCORHYNCHUS KETA* WALBAUM. *Bull. Jpn. Soc. Sci. Fish.* 46(7):911. July 1980. SFA 26(1)
[Kyoto Coll. Pharm., Yamashina, Kyoto 607, Japan]

81-000258 Maugle, P. D. and T. L. Meade. USE OF SPECIFIC-ION ELECTRODE FOR THE DETERMINATION OF UN-IONIZED AMMONIA IN FISH BLOOD. *Prog. Fish-Cult.* 42(4):224-228. Oct. 1980. SFA 26(1)
[Fac. Fish., Lab. Mar. Biochem., Kagoshima Univ., Kagoshima-shi 890, Japan]

81-000259 Meade, T. L. and S. J. Perrone. SELECTIVE HAEMATOLOGICAL PARAMETERS IN STEELHEAD TROUT, *Salmo gairdneri* RICHARDSON. *J. Fish Biol.* 17(1):9-12. July 1980. SFA 26(1)
[Dep. Anim. Sci., Coll. Resour. Dev., Univ. R.I., Kingston 02881] Fifteen steelhead trout, *Salmo gairdneri*, were assayed for selective blood parameters. The trout were reared under flow-through conditions at the salmonid aquaculture facility at the University of Rhode Island. The means of the measured haematological parameters were: pH, 7.59 ± 0.05; pCO_2, 8.5 ± 1.05 mmHg; HCO_3^-, 11.9 ± 1.9 meq/l; Ferri-Hb, 21.7 ± 2.0%; Cl^-, 147 ± 17.8 meq/l; Hct, 30.7 ± 4.8%.

81-000260 Medda, A. K.: A. K. Dasmahapatra and A. K. Ray. EFFECT OF ESTROGEN AND TESTOSTERONE ON THE PROTEIN AND NUCLEIC ACID CONTENTS OF LIVER, MUSCLE, AND GONAD AND PLASMA PROTEIN CONTENT OF MALE AND FEMALE (VITELLOGENIC AND NONVITELLOGENIC) SINGI FISH, *HETEROPNEUSTES FOSSILIS* BLOCH. *Gen. Comp. Endocrinol.* 42(4):427-436. Dec. 1980. SFA 26(1)
[Dep. Anim. Physiol., Bose Inst., Calcutta, India]

81-000261 Meyerhoff, R. D. EXERCISE AND ACID-BASE BALANCE IN RAINBOW TROUT. *Ph.D. dissertation, Oreg. State Univ.* 97p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1263. Oct. 1980. SFA 26(1)

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[Serv. Med. Nucl., Fac. Med., St.-Antoine, Paris, France]

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81-000264 Morris, R. BLOOD COMPOSITION AND OSMOREGULATION IN AMMOCOETE LARVAE. *Can. J. Fish. Aquatic Sci.* 37(11):1665-1679. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Zool., Univ. Nottingham, University Park, Nottingham NG7 2RD, England]

81-000265 Morrow, W. J. W. and A. Pulsford. IDENTIFICATION OF PERIPHERAL BLOOD LEUCOCYTES OF THE DOGFISH (*SCYLIORHINUS CANICULA* L.) BY ELECTRON MICROSCOPY. *J. Fish Biol.* 17(4):461-475. Oct. 1980. SFA 26(1)
[Dep. Immunol., Middlesex Hosp. Med. Sch., London W1P 9PG, England] Dogfish peripheral blood leucocytes were examined by electron microscopy after the injection of colloidal carbon. The cells were classified as lymphocytes, plasma cells, monocytes, thrombocytes and granulocytes. The granulocytes were further classified into four types according to the structure of their granules. Monocytes, thrombocytes and two types of the granulocytic cells were phagocytic.

81-000266 Murdy, E. O. and J. W. E. Wortham, Jr. CONTRIBUTIONS TO THE REPRODUCTIVE BIOLOGY OF THE EASTERN PIRATEPERCH, *APHREDODERUS SAYANUS*. *Va. J. Sci.* 31(1-2):20-27. 1980. SFA 26(1)
[Dep. Biol. Sci., Old Dominion Univ., Norfolk, VA 23509] The reproductive system (including ovarian and testicular development) of *Aphredoderus sayanus* is described. The gonads of forty-three specimens (13 male; 29 female; one undetermined) were examined histologically and a gonosomatic index (GSI--the ratio of total gonad weight to total body weight) was calculated for each individual. Gonads began to ripen in the fall, with the testes maturing sooner than the ovaries. Sperm were seen in November males while mature eggs were not detected until April 1. *Aphredoderus sayamus* is a spring spawner.

81-000267 Murphy, T. M. THE EFFECT OF METHALLIBURE AND CYPROTERONE ACETATE ON THE GONADOTROPHIC CELLS, PLASMA ANDROGEN LEVELS AND TESTES OF PRECOCIOUS 1+ MALE ATLANTIC SALMON PARR *SALMO SALAR* L. *J. Fish Biol.* 17(6):673-680. Dec. 1980. SFA 26(1)
[Dep. Agric., Vet. Res. Lab., Abbotstown, Castleknock, Co. Dublin, Ireland] Developing 1+ male Atlantic salmon parr were treated with methallibure and cyproterone acetate. Both these drugs failed to prevent gonad maturation but they did decrease the gonadotrophic cell size and lower plasma androgen levels. These results are discussed in relation to previous studies. It is concluded that gonadotrophic cells control gonadal androgen production, that cyproterone acetate is a central inhibitor of gonadotrophin production and that these two chemical agents could be effective as chemosterilants if administered early in gonad maturation cycle.

81-000268 Myers, S. F. and V. L. Avila. TRITIATED 17β-ESTRADIOL UPTAKE BY THE BRAIN AND OTHER TISSUES OF THE CICHLID JEWEL FISH, *HEMICHROMIS BIMACULATUS*. *Gen. Comp. Endocrinol.* 42(2):203-211. Oct. 1980. SFA 26(1)
[Anat. Dep., Univ. Mich., Ann Arbor 48109]

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[Dep. Biol., Keio Univ., Yokohama 223, Japan]

81-000270 Neighbors, M. A. LIPIDS, SWIMBLADDERS, AND BUOYANCY IN MESOPELAGIC FISHES. *Am. Zool.* 20(4):836. 1980. Abstract only. SFA 26(1)
[Univ. South. Calif., Los Angeles]

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[Div. Physiol., Univ. Helsinki, Arkadiankatu 7, SF-00100 Helsinki 10, Finland]

81-000272 Nishioka, R. S.; E. G. Grau and H. A. Bern. GROWTH HORMONE RELEASE *IN VITRO* FROM THE PITUITARY GLAND OF TILAPIA, *SAROTHERODON MOSSAMBICUS*. *Am. Zool.* 20(4):859. 1980. Abstract only. SFA 26(1)
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[Dep. Biol., Aichi Univ. Educ., Igaya-cho, Kariya-shi, Aichi 448, Japan]

81-000274 Paladino, F. V.; J. R. Spotila; J. P. Schubauer and K. T. Kowalski. THE CRITICAL THERMAL MAXIMUM: A TECHNIQUE USED TO ELUCIDATE PHYSIOLOGICAL STRESS AND ADAPTATION IN FISHES. *Rev. Can. Biol.* 39(2):115-122. June 1980. SFA 26(1)
[Dep. Zool., Miami Univ., Oxford, OH 45056]

81-000275 Paxton, R. and B. L. Umminger. THE EFFECTS OF COLD-ACCLIMATION ON THE ENZYMES ASSOCIATED WITH CARBOHYDRATE METABOLISM IN THE GOLDFISH, *CARASSIUS AURATUS*. *Am. Zool.* 20(4):731. 1980. Abstract only. SFA 26(1)
[Univ. Cincinnati, Cincinnati, OH]

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[Univ. West Fla., Pensacola]

81-000277 Perrier, H.; G. Llaurens; C. Perrier; G. Pérès and J. Gras. ÉTUDE DES ACTIVITÉS DE DOUZE ENZYMES DU PLASMA SANGUIN DE LA TRUITE ARC-EN-CIEL ET DE LA TANCHE SOUMISES À DIVERSES FORMES DE CONTRAINTE THERMIQUE. [ACTIVITIES OF TWELVE ENZYMES IN THE BLOOD PLASMA OF THE RAINBOW TROUT AND OF THE TENCH SUBMITTED TO VARIOUS FORMS OF THERMAL DISTURBANCE.] *Rev. Can. Biol.* 39(3):141-147. Sept. 1980. In French with English summ. SFA 26(1)
[Lab. Pharmaceut. Biochim., Fac. Pharm., 69373 Lyon, Cedex 2, France]

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[Dep. Zool., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

81-000279 Phillips, J. O. and D. D. Ourth. ISOLATION AND CHARACTERIZATION OF IMMUNOGLOBULIN HEAVY CHAIN IN THE CHANNEL CATFISH. *Am. Zool.* 20(4):865. 1980. Abstract only. SFA 26(1)
[Memphis State Univ., Memphis, TN]

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[NADPLR, U.S. Army Corps of Engineers, 90 Church St., New York, NY 10007]

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[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

81-000284 Quast, W. D. and N. R. Howe. THE OSMOTIC ROLE OF THE BROOD POUCH IN THE PIPEFISH *SYNGNATHUS SCOVELLI*. *Comp. Biochem. Physiol. A Comp. Physiol.* 67(4):675-678. 1980. SFA 26(1)
[Biol. Dep., Univ. Houston, Houston, TX 77004]

81-000285 Radtke, R. L. and D. F. Williams. THE REGULATION OF THE STABLE ISOTOPIC COMPOSITION OF FISH OTOLITHS. *Am. Zool.* 20(4):770. 1980. Abstract only. SFA 26(1)
[Belle W. Baruch Inst., Univ. S.C., Columbia]

81-000286 Raffin, J. P. and C. Leray. COMPARATIVE STUDY ON AMP DEAMINASE IN GILL, MUSCLE AND BLOOD OF FISH. *Comp. Biochem. Physiol. B Comp. Biochem.* 67(4):533-540. 1980. SFA 26(1)
[Lab. Physiol. Comp. Regul., C.N.R.S., B.P. 20 CR, 67037 Strasbourg-Cedex, France]

81-000287 Rasmussen, L. E. COMPARATIVE DISTRIBUTION OF NITROGENOUS COMPOUNDS IN *ACIPENSER TRANSMONTANUS* AND *HYDROLAGUS COLLIEI*: ENZYME KINETICS AND ISOZYME RATIOS ALTERATIONS. *Comp. Biochem. Physiol. B Comp.*

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81-000287 CONTINUED *Biochem.* 67(4):665-677. 1980. SFA 26(1)
[Oreg. Grad. Cent., 19600 N.W. Walker Rd., Beaverton, 97005]

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[W. E. Stumpf: Dep. Anat., 111 Swing Bldg., Univ. N.C., Chapel Hill 27514]

81-000289 Romanenko, V. D. and N. Yu. Yevtushenko. THE EFFECT OF Mg^{2+} and Ca^{2+} ON SOME PHASES IN THE METABOLIC PROCESSES OF THE CARP, *CYPRINUS CARPIO*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):125-130. 1979. SFA 26(1)
[Inst. Hydrobiol., Ukrainian USSR Acad. Sci., Kiev, USSR]

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[Dep. Physiol. Biophys., Washington Univ. Sch. Med., St. Louis, MO 63110]

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[A.E. De Ioannes: Dep. Biol. Cell., Inst. Ciencias Biol., Pontif. Univ. Catol. Chile, Casilla 114-D Santiago, Chile]

81-000292 Sakamoto, S. and Y. Yone. A PRINCIPAL SOURCE OF DEPOSITED LIPID IN PHOSPHORUS DEFICIENT RED SEA BREAM. *Bull. Jpn. Soc. Sci. Fish.* 46(10):1227-1230. Oct. 1980. SFA 26(1)
[Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka 811-33, Japan]

81-000293 Sakata, T.; H. Sugita; T. Mitsuoka; D. Kakimoto and H. Kadota. ISOLATION AND DISTRIBUTION OF OBLIGATE ANAEROBIC BACTERIA FROM THE INTESTINES OF FRESHWATER FISH. *Bull. Jpn. Soc. Sci. Fish.* 46(10):1249-1255. Oct. 1980. SFA 26(1)
[Fac. Fish., Kagoshima Univ., Kagoshima 890, Japan]

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[Inst. Biochem., Odense Univ., Campusvej 55, 5230 Odense M, Denmark]

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[Dep. Biol., Brooklyn Coll., NY 11210]

81-000296 Scott, A. P.; V. J. Bye; S. M. Baynes and J. R. C. Springate. SEASONAL VARIATIONS IN PLASMA CONCENTRATIONS OF 11-KETOTESTOSTERONE AND TESTOSTERONE IN MALE RAINBOW TROUT, *SALMO GAIRDNERII* RICHARDSON. *J.*

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81-000296 CONTINUED *Fish Biol.* 17(5):495-505. Nov. 1980. SFA 26(1)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk NR33 0HT, England]

81-000297 Scott, A. P.; V. J. Bye and S. M. Baynes. SEASONAL VARIATIONS IN SEX STEROIDS OF FEMALE RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON). *J. Fish Biol.* 17(5):587-592. Nov. 1980. SFA 26(1)
[Minist. Agric. Fish Food, Dir. Fish. Res., Fish. Lab., Lowestoft, Suffolk NR33 0HT, England] 17ß-oestradiol, testosterone, 11-ketotestosterone and calcium were measured in plasma of female rainbow trout over the course of a single spawning season. The patterns of rise and fall of the levels of 17β-oestradiol and calcium during sexual maturation were similar to those demonstrated by other workers. Very high levels of testosterone were found in plasma of sexually mature fish--mean level 211 ng/ml in November and 115 ng/ml in January. Ovulation occurred from December to February.

81-000298 Scott, D. B. C. and S. E. Rennie. NUCLEAR DIAMETER AS A CRITERION OF ADRENOCORTICAL ACTIVITY IN A TELEOST FISH *COREGONUS LAVARETUS* (L.). *J. Fish Biol.* 17(1):83-90. July 1980. SFA 26(1)
[Zool. Dep., Univ. St. Andrews, Fife, Scotland]

81-000299 Shapiro, D. Y. ROLE OF FEMALES IN THE INITIATION OF SEX CHANGE IN A CORAL REEF FISH. *Am. Zool.* 20(4):826. 1980. Abstract only. SFA 26(1)
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[Hokkaido Univ., Hokodate, Japan]

81-000301 Shimizu, M. and H. Takahashi. [PROCESS OF SEX DIFFRENTIATION OF THE GONAD AND GONODUCT OF THE THREE-SPINED STICKLEBACK, *GASTEROSTEUS ACULEATUS* L.] *Bull. Fac. Fish. Hokkaido Univ.* 31(2):137-148. June 1980. In Japanese with English summ. SFA 26(1)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Minato-cho, Hakodate 041, Japan]

81-000302 Shuttleworth, T. J. and J. L. Thompson. THE MECHANISM OF CYCLIC AMP STIMULATION OF SECRETION IN THE DOGFISH RECTAL GLAND. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 140(3):209-216. Dec. 1980. SFA 26(1)
[Dep. Biol. Sci., Univ. Exeter, Exeter EX4 4PS, England]

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[Dep. Biol. Sci., The Polytechnic, Wolverhampton, WV1 1LY, England]

81-000304 Smit, G. L. and J. Hattingh. HAEMATOLOGICAL ASSESSMENT OF GENERALLY USED FRESHWATER FISH BLOOD ANTICOAGULANTS. *J. Fish. Biol.* 17(4):337-341. Oct. 1980. SFA 26(1)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa]

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81-000305 Smith, A. C. and F. Ramos. AUTOMATED CHEMICAL ANALYSIS IN FISH HEALTH ASSESSMENT. *J. Fish Biol.* 17(4):445-450. Oct. 1980. SFA 26(1)
[Dep. Pathol., Coll. Med., Univ. Fla., Gainesville 32601] Before and after application of severe, debilitating stress, automated chemical analysis was applied to the skin mucus and the serum of four subsistence fish species: *Chanos chanos, Mugil cephalus, Sarotherodon macrochir* and *S. mossambicus*. Certain tests were found to reflect the stress effects. Future use of these tests may be on an individual, less expensive basis. Greater use of mucus for analysis is suggested because it is more accessible and less traumatically obtained than blood.

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[Inst. Zoophysiol., Univ. Oslo, P.O. Box 1051, Blindern, Oslo 3, Norway] The significance of the olfactory sense upon sexual maturation in Atlantic salmon was studied. Eighty-one salmon in the salt-water stage were rendered anosmic by cauterizing the olfactory mucosa, a further 81 fishes served as a reference group. All fishes were raised in the same floating net cage. The olfactory mucosa was destroyed once more during the experimental period in the already anosmicized group in order to avoid regeneration. After 5 months, the sexual maturation in both groups was determined by visual inspection of the gonads, and ranged on a six-step scale. The results indicate that the olfactory sense is not mandatory to late development of sexual maturity. No difference was found between the two groups with regard to growth during the experimental period. This finding indicates that the olfactory sense is of little importance to salmonids in the competition for food in a fish-farming environment.

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[Tokai Reg. Fish. Res. Lab., Kachidoki, Chuo-ku, Tokyo 104, Japan]

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[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada]

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[Zool. Inst., Univ. Oslo, Box 1050, Blindern, Oslo 3, Norway]

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[Sch. Fish. Sci., Kitasato Univ., Okirai, Sanriku, Iwate 022-01, Japan]

81-000318 Weatherley, A. H.; H. S. Gill and S. C. Rogers. GROWTH DYNAMICS OF MASAIC MUSCLE FIBRES IN FINGERLING RAINBOW TROUT (*SALMO GAIRNDERI*) IN RELATION TO SOMATIC GROWTH RATE. *Can. J. Zool.* 58(9):1535-1541. Sept. 1980. In English with French summ. SFA 26(1)
[Life Sci. Div., Scarborough Coll., Univ. Toronto, West Hill, ON M1C 1A4, Canada]

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[Wake Forest Univ., Winston-Salem, NC]

81-000320 Wedemeyer, G. A.; R. L. Saunders and W. C. Clarke. ENVIRONMENTAL FACTORS AFFECTING SMOLTIFICATION AND EARLY MARINE SURVIVAL OF ANADROMOUS SALMONIDS. *Mar. Fish. Rev.* 42(6):1-14. June 1980. SFA 26(1)
[U.S. FWS, Bldg. 204, Naval Support Activity, Seattle, WA 98115] An important requirement in the efficient use of artificially propagated juveniles for salmon enhancement programs is that the resulting smolts be

PHYSIOLOGY (CONTINUED)

81-000320 CONTINUED fully prepared behaviorally and physiologically to migrate to sea and continue to grow and develop normally. In this paper, physiological criteria for identifying fully functional smolts are presented and environmental factors are identified which will influence smoltification, and thus early marine survival. Methods are described for optimizing time, age, and size at release, and data are presented on methods of environmental manipulation to alter smoltification to fit specific resource management needs. On the basis of our present understanding of the physiology of the parr-smolt transformation and of the influence of environmental alterations during rearing, guidelines are presented for management strategies to improve survival of Pacific, *Oncorhynchus* sp., and Atlantic salmon, *Salmo salar*, and anadromous (steelhead) rainbow trout, *Salmo gairdneri*.

81-000321 Weisbart, M. *IN VITRO* INCUBATION OF PRONEPHRIC TISSUE FROM THE PACIFIC HAGFISH, *EPTATRETUS STOUTI*. *Am. Zool.* 20(4):764. 1980. Abstract only. SFA 26(1)
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[La. State Univ., Baton Rouge]

81-000323 Wells, R. M. G.; M. D. Ashby; S. J. Duncan and J. A. Macdonald. COMPARATIVE STUDY OF THE ERYTHROCYTES AND HAEMOGLOBINS IN NOTOTHENIID FISHES FROM ANTARCTICA. *J. Fish Biol.* 17(5):517-527. Nov. 1980. SFA 26(1)
[Dep. Zool., Univ. Auckland, Auckland, New Zealand]

81-000324 Wendelaar Bonga, S. W.; J. C. A. van der Meij and P. K. T. Pang. EVIDENCE OF TWO SECRETORY CELL TYPES IN THE STANNIUS BODIES OF THE TELEOSTS *FUNDULUS HETEROCLITUS* AND *CARASSIUS AURATUS*. *Cell Tissue Res.* 212(2):295-306. Nov. 1980. SFA 26(1)
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[J. M. Burns: Dep. Pharmacol., Sch. Med., Tex. Tech. Univ. Health Sci. Cent., Lubbock 79409]

81-000326 Wiegand, M. D. and D. R. Idler. EFFECTS OF ANTIBODY TO GLYCOPROTEIN GTH ON OVARIAN GROWTH IN *SALMO SALAR*. *Am. Zool.* 20(4):730. 1980. Abstract only. SFA 26(1)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF, Canada]

81-000327 Woo, N. Y. S. and S. I. Cheung. METABOLIC EFFECTS OF STARVATION IN THE SNAKEHEAD, *OPHIOCEPHALUS MACULATUS*. *Comp. Biochem. Physiol. A Comp Physiol.* 67(4):623-637. 1980. SFA 26(1)
[Dep. Biol., Chinese Univ. Hong Kong, Shatin, Hong Kong]

81-000328 Wootton, R. J.; J. R. M. Allen and S. J. Cole. ENERGETICS OF THE ANNUAL REPRODUCTIVE CYCLE IN FEMALE STICKLEBACKS, *GASTEROSTEUS ACULEATUS* L. *J. Fish Biol.* 17(4):387-394. Oct. 1980. SFA 26(1)

PHYSIOLOGY (CONTINUED)

81-000328 CONTINUED
[Dep. Zool., Univ. Coll. Wales, Aberystwyth, Dyfed, Wales] Laboratory studies on the three-spined stickleback provided predictive equations for the relationships between food consumption, faecal production and growth, and between respiration rate and body weight. These equations were used to estimate the energy income and expenditure at monthly intervals during the annual reproductive cycle of females of mean length from two populations. In winter only a small precentage of the energy income was invested in ovarian or somatic growth, and the latter was negative in some cases. Routine respiration and faecal losses accounted for a high proportion of the energy income. In spring a higher proportion of the energy income was partitioned into somatic and ovarian growth while routine respiration accounted for a smaller proportion of the energy income.

81-000329 Wootton, R. J.; J. R. M. Allen and S. J. Cole. EFFECT OF BODY WEIGHT AND TEMPERATURE ON THE MAXIMUM DAILY FOOD CONSUMPTION OF *GASTEROSTEUS ACULEATUS* L. AND *PHOXINUS PHOXINUS* (L.):SELECTING AN APPROPRIATE MODEL. *J. Fish Biol.* 17(6):695-705. Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Coll. Wales, Aberystwyth, Dyfed, Wales] The relationships between the maximum daily food consumption, body weight and water temperature for the stickleback, *Gasterosteus aculeatus* L., and the minnow, *Phoxinus phoxinus* (L.), were studied. The two species occupy the same lakes in mid-Wales, but differ in that *G. aculeatus* has a true stomach whereas *P. phoxinus* lacks a true stomach. For both species, the relationship between food consumption (F) and body weight (W) could be described by the model: $\log_e F = a + b \log_e W$. The effect of temperature (T) could be incorporated in the form: $\log_e F = a + b_1 \log_e W + b_2 \log_e T$. These models were selected because they accounted for a high proportion of the variance in the dependent variable, and because an analysis of the residuals obtained after fitting a model showed no trends which would have signalled the inadequacy of the model.

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[Clemson Univ., Clemson, SC]

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[TVA, Biotherm. Res. Stn., Decatur, AL 35602]

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[Dep. Zool., Scarborough Coll., Univ. Toronto, West Hill, ON M1C 1A4, Canada]

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[J. H. Youson: Dep. Zool., Univ. TOronto, Scarborough Coll., West Hill, ON M1C 1A4, Canada]

81-000334 Yamada, K.; K. Kobayaski and Y. Yone. CONVERSION OF LINOLENIC ACID TO ω3-HIGHLY UNSATURATED FATTY ACIDS IN MARINE FISHES AND RAINBOW TROUT. *Bull. Jpn. Soc. Sci. Fish.* 46(10):1231-1233. Oct. 1980. SFA 26(1)
[Fish Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka 811-33, Japan]

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[Dep. Zool., George S. Wise Fac. Life Sci., Tel Aviv Univ., Tel Aviv, Israel]

81-000336 Yarzhombek, A. A.; V. I. Zdor and T. V. Shcherbina. CORRELATION OF THE METABOLIC RATE IN THE STARVING AND FEEDING YOUNG OF THE CARP, *CYPRINUS CARPIO*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):167-170. 1979. SFA 26(1)
[VNIIPRKh, Rybnoye Settlement, Moscow Prov., USSR]

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[Lab. Microbiol., Fac. Fish., Hokkaido Univ., Hokodate, Hokkaido 041, Japan]

81-000339 Yoshizaki, N.; R. J. Sackers; A. F. M. Schoots and J. M. Denucé. ISOLATION OF HATCHING GLAND CELLS FROM THE TELEOST, *ORYZIAS LATIPES*, BY CENTRIFUGATION THROUGH PERCOLL. *J. Exp. Zool.* 213(3):427-429. Sept. 1980. SFA 26(1)
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[U.S. Environ. Prot. Agency, Monicello, MN]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

81-000342 Allendorf, F. W. and S. R. Phelps. LOSS OF GENETIC VARIATION IN A HATCHERY STOCK OF CUTTHROAT TROUT. *Trans. Am. Fish. Soc.* 109(5):537-543. Sept. 1980. SFA 26(1)
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GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

81-000343 Arai, K. and F. Yamazaki. DEVELOPMENTAL GENETICS ON THE LACTATE DEHYDROGENASE (LDH) ISOZYME DURING EARLY EMBRYOGENESIS IN SALMONIDS. *Bull. Fac. Fish. Hokkaido Univ.* 31(3):223-228. Aug. 1980. SFA 26(1)
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81-000344 Butcher, G. A. MULTIVARIATE ANALYSIS OF HYBRIDIZING CYPRINIDAE FROM THE KANANASKIS RESERVOIRS, ALBERTA. *Can. J. Zool.* 58(9):1664-1673. Sept. 1980. In English with French summ. SFA 26(1)
[Resour. Anal. Br., 765 Broughton St., Victoria, BC V8V 1X4, Canada] Principal components and canonical variates analyses of hybridizing *Couesius plumbeus* (lake chub) and *Rhinichthys cataractae* (longnose dace) from Upper and Lower Kananaskis Reservoirs, Alberta, using 21 morphological characters, revealed two parental groups bridged continuously by an intermediate hybrid group. This morphological overlap between the hybrids and the parental species indicates that it is not always possible to positively identify "pure" parental individuals from the Kananaskis. Neither backcross nor hybrid F2 individuals could be identified from the analyses, although the Kananaskis *R. cataractae* showed effects suggestive of either selection or introgression, relative to known *R. cataractae* from widespread Alberta localities. *Rhinichthys cataractae* has also declined in numbers relative to *C. plumbeus* since last studied in 1961. *Couesius plumbeus* does not show similar effects suggestive of selection or introgression.

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[G.S. Whitt: Dep. Genet. Dev., 515 Morrill Hall, Univ. Ill., Urbana 61801]

81-000346 Fisher, S. E.; J. B. Shaklee; S.D. Ferris and G. W. Whitt. EVOLUTION OF FIVE MULTILOCUS ISOZYME SYSTEMS IN THE CHORDATES. *Genetica* 52-53:73-85. 1980. SFA 26(1)
[G.S. Whitt: Dep. Genet. Dev., 515 Morrill Hall, Univ. Ill., Urbana 61801]

81-000347 Gervai, J.; S. Péter¨A. Nagy¨L. Horváth and V. Csányi. INDUCED TRIPLOIDY IN CARP, *CYPRINUS CARPIO* L. *J. Fish Biol.* 17(6):667-671. Dec. 1980. SFA 26(1)
[Dep. Human Genet., Natl. Inst. Hygiene, Budapest, Hungary] A method for mass production of triploid carp was developed by the cold treatment of eggs after fertilization. Triploidy was demonstrated by cytophotometry and chromosome preparation techniques. Of the haploid embryos, 100% showed morphological abnormalities and died soon after hatching. Haploid embryos of maternal and paternal origin occuring in the course of cold treatment were distinquished by using a genetic marker. Among morphologically normal larvae, the frequency of triploidy was 100%, and the viability of the triploid embryos, larvae and the juvenile fish did not differ from the diploid control. Sex differentiation started in the triploid fish, but greatly retarded. Gonad size and the small number of growing oocytes suggest that most of the triploid individuals will be sterile. Triploid carp grew at the same rate as diploid controls in the laboratory test.

81-000348 Healy, J. A. and M. F. Mulcahy. A BIOCHEMICAL GENETIC ANALYSIS OF POPULATIONS OF THE NORTHERN PIKE, *ESOX LUCIUS* L., FROM EUROPE AND NORTH AMERICA. *J. Fish Biol.* 17(3):317-324. Sept. 1980. SFA 26(1)
[Dep. Zool., University College, Cork, Ireland] Genetic variation as identified by starch gel electrophoresis and enzyme staining was studied in seven populations of the northern pike, *Esox lucius* L. Samples derived from populations in northern U.S., Canada, Swedish fresh water, Swedish Baltic, the Netherlands, England and Ireland were analysed for variation at between 10 and 26 enzyme-coding loci. Polymorphism was found to be restricted

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

81-000348 CONTINUED to three loci: *Sod*-1 (mitochondrial superoxide dismutose), *Ldh-2* (heart-type lactate dehydrogenase) and *Got*-1 (cytoplasmic glutamateoxalate transaminase). Mean heterozygosity (H) over all seven population samples was estimated to be 0.019. This extremely low variability, relative to reported data for other fish species, is discussed in terms of the sturcture and possible origins of pike populations.

81-000349 Joswiak, G. R. GENETIC DIVERGENCE WITHIN A GENUS OF CYPRINID FISH (*PHOXINUS*: CYPRINIDAE). *Ph.D. dissertation, Wayne State Univ.* 55p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1205. Oct. 1980. SFA 26(1)

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[Dep. Biol., Wayne State Univ., Detroit, MI 48202]

81-000351 Krueger, C. C. DETECTION OF VARIABILITY OF ISOZYME LOCI IN SEA LAMPREY, *PETROMYZON MARINUS*. *Can. J. Fish. Aquatic Sci.* 37(11):1630-1634. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Entomol. Fish Wildl., Univ. Minn., St. Paul 55108]

81-000352 Lemoine, H. L., Jr. and L. T. Smith. POLYPLOIDY INDUCED IN BROOK TROUT BY COLD SHOCK. *Trans. Am. Fish. Soc.* 109(6):626-631. Nov. 1980. SFA 26(1)
[Dep. Anim. Pathol., Univ. R.I., Kingston 02881]

81-000353 Lugaski, T. P. COMPARATIVE CHEMOTAXONOMY OF SELECTED GREAT BASIN NATIVE CYPRINID FISHES. *Ph.D. dissertation, Univ. Nev. (Reno)* 267p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1207. Oct. 1980. SFA 26(1)

81-000354 MacLean, J. ECOLOGICAL GENETICS OF THREESPINE STICKLEBACKS IN HEISHOLT LAKE. *Can. J. Zool.* 58(11):2026-2039. Nov. 1980. In English with French summ. SFA 26(1)
[Minist. Nat. Resour., Box 50, Maple, ON L0J 1E0, Canada] A series of experiments were conducted to examine interactions between the genetics and ecology of threespine sticklebacks in Heisholt lake. Frequencies of plate phenotypes varied spatially between both areas and depths of the lake and temporally within and between generations. Movement experiments showed that the population is composed of residents, who remain in a restricted area and appear to maintain either a breeding or a feeding territory, and nonresidents, who move between areas. The plate phenotype of a stickleback influenced its chances to become a resident, but the favored phenotype varied in both space and time. Rare phenotypes appeared to have an advantage in competition for territories and increased in relative frequency within cohorts. Density of sticklebacks also influenced the fitness of phenotypes. These observations suggest the hypothesis that the observed spatial and temporal changes in plate phenotype frequencies were the result of competition between phenotypes for territories.

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[Dep. Biol., Pa. State Univ., University Park 16802]

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81-000356 Mayden, R. L. and B. M. Burr. TWO NATURAL DARTER HYBRIDS INVOLVING MEMBERS OF THE GENUS *ETHEOSTOMA* (PISCES: PERCIDAE). *Am. Midl. Nat.* 104(2):390-393. Oct. 1980. SFA 26(1)
[Dep. Zool., South. Ill. Univ., Carbondale 62901]

81-000357 Mulley, J. C. and K. D. Shearer. IDENTIFICATION OF NATURAL 'YANCO' X 'BOOLARA' HYBRIDS OF THE CARP, *CYPRINUS CARPIO* LINNAEUS. *Aust. J. Mar. Freshwater Res.* 31(3):409-411. June 1980. SFA 26(1)
[Cytogenet. Unit, Dep. Histopathol., Adelaide Children's Hosp., North Adelaide, Australia]

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[Dep. Biol., Univ. South. Miss., Hattiesburg 39401]

81-000361 Reid, G. M. 'EXPLOSIVE SPECIATION' OF CARPS IN LAKE LANAO (PHILIPPINES)--FACT OR FANCY? *Syst. Zool.* 29(3):314-316. Sept. 1980. SFA 26(1)
[Dep. Biol. Sci., Univ. Sokoto, Sokoto, Northern Nigeria]

81-000362 Sola, L.; G. Gentili and S. Cataudella. EEL CHROMOSOMES: CYTOTAXONOMICAL INTERRELATIONSHIPS AND SEX CHROMOSOMES. *Copeia* 1980(4):911-913. 5 Dec. 1980. SFA 26(1)
[Inst. Comp. Anat., Univ. Rome, 00161 Rome, Italy]

81-000363 Tripathy, N. K. and C. C. Das. CHROMOSOMES IN THE THREE SPECIES OF ASIAN CATFISH. *Copeia* 1980(4):916-918. 5 Dec. 1980. SFA 26(1)
[Dep. Zool., Berhampur Univ., Berhampur 760 007, Orissa, India]

81-000364 Wishard, L. N.; F. M. Utter and D. R. Gunderson. STOCK SEPARATION OF FIVE ROCKFISH SPECIES USING NATURALLY OCCURRING BIOCHEMICAL GENETIC MARKERS. *Mar. Fish. Rev.* 42(3-4):64-73. Mar.-Apr. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Stock relationships of five commercially important rockfish (genus *Sebastes*) species were studied using biochemical genetic information developed through electrophoresis. Samples of Pacific ocean perch, *S. alutus*, were collected off Washington and Oregon and in the Gulf of Alaska from Dixon Entrance to Kodiak. Three stock groups were recognized for Pacific ocean perch. One exists off the Washington and Oregon coasts, while another is found in the Gulf of Alaska. A third previously unrecognized stock was tentatively identified off Prince William Sound. Samples of canary rockfish, *S. pinniger*; yellowtail rockfish, *S. flavidus*; chillipepper, *S. goodei*; and bocaccio, *S. paucispinis*, were collected off the California, Oregon, and Washington coasts. Two stocks may exist for canary

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

81-000364 CONTINUED rockfish--one located off northern California and southern Oregon and the other located off northern Oregon and Washington. Only one stock group per species was recognized for yellowtail rockfish, chilipepper, and bocaccio. The relationship of the different species to each other and the general applications of the techniques of electrophoresis to work in marine fisheries are also discussed.

BEHAVIOR

81-000365 Andörfer, B. THE SCHOOL BEHAVIOR OF *LEUCASPIUS DELINEATUS* (HECKEL) IN RELATION TO AMBIENT SPACE AND THE PRESENCE OF A PIKE (*ESOX LUCIUS*). *Oecologia (Berl.)* 47(1):137-140. Oct. 1980. SFA 26(1)
[Zool. Inst. Tech. Univ., Pockelstr. 10a, D-3300 Braunschweig, West Germany] Tests were carried out to study school concentration in relation to quality of space and presence of pike. At a water depth of 60 cm (without pike) school concentration is very much lower than at 20 cm, both at 980 lux and at 0.02 lux. At 0.02 lux in the absence of the predator, the shapes of the water space cannot be ascertained to have an influence. At 980 lux (with and without pike) Shape IV has an intense effect on school concentration. In the dark (0.02 lux) the effect of a pike in intensifying school formation is smaller, the larger the quantity of water.

81-000366 Barila, T. Y. and J. R. Stauffer, Jr. TEMPERATURE BEHAVIORAL RESPONSES OF THE AMERICAN EEL, *ANGUILLA ROSTRATA* (LESUEUR), FROM MARYLAND. *Hydrobiologia* 74(1):49-51. 1 Sept. 1980. SFA 26(1)
[Appalachian Environ. Lab., Univ. Md., Gunter Hall, Frostburg 21532] Acute temperature preference tests were conducted with American eels, *Anguilla rostrata*, collected from Maryland's eastern shore. Eels were acclimated to temperatures of 6, 12, 18, 24 and 30°C. Final temperature preferendum was 16.7°C. Data differ from the temperature responses of the majority of fishes tested to date in that acclimation temperature did not influence selected temperatures. Similar results were obtained for various other fishes (*Oncorhynchus*, *Salmo*, *Salvelinus*) by other investigators. Behavioral responses at various acclimation temperatures were observed.

81-000367 Barwick, D. H. SUMMER TEMPERATURE PREFERENCES OF THE FLAT BULLHEAD IN KEOWEE RESERVOIR, SOUTH CAROLINA. *Prog. Fish-Cult.* 42(4):230-231. Oct. 1980. SFA 26(1)
[U.S. FWS, Southeast Reservoir Invest., 206 Highway 123 By-Pass, Clemson, SC 29631]

81-000368 Bernstein, J. W. PARENTAL CARE BEHAVIOR IN THE CICHLID FISH *CICHLASOMA NIGROFASCIATUM*. *Copeia* 1980(4):682-686. 5 Dec. 1980. SFA 26(1)
[Dep. Vet. Pathol., Univ. Saskatchewan, Saskatoon, SK S7N 0W0, Canada]

81-000369 Berti, R. and G. Thinès. INFLUENCE OF CHEMICAL SIGNALS ON THE TOPOGRAPHIC ORIENTATION OF THE CAVE FISH *CAECOBARBUS GEERTSI* BOULENGER (PISCES, CYPRINIDAE). *Experientia (Basel)* 36(12):1384-1385. 15 Dec. 1980. SFA 26(1)
[Inst. Zool., Univ. Firenze, Via Romana 17, I-50125 Firenze, Italy]

81-000370 Blaber, S. J. M. and T. G. Blaber. FACTORS AFFECTING THE DISTRIBUTION OF JUVENILE ESTUARINE AND INSHORE FISH. *J. Fish Biol.* 17(2):143-162. Aug. 1980. SFA 26(1)
[Zool. Dep., Univ. Natal, Pietermartzburg, Natal 3200, South Africa]

BEHAVIOR (CONTINUED)

81-000371 Blake, R. W. UNDULATORY MEDIAN FIN PROPULSION OF TWO TELEOSTS WITH DIFFERENT MODES OF LIFE. *Can. J. Zool.* 58(11):2116-2119. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Zool., Univ. British Columbia, Vancouvèr, BC V6T 1W5, Canada]

81-000372 Brandt, S. B.; J. J. Magnuson and L. B. Crowder. THERMAL HABITAT PARTITIONING BY FISHES IN LAKE MICHIGAN. *Can. J. Fish. Aquatic Sci.* 37(10):1557-1564. Oct. 1980. SFA 26(1)
[CSIRO Div. Fish. Oceanogr., P.O. Box 21, Cronulla, 2230 N.S.W., Australia]

81-000373 Caprio, J. SIMILARITY OF OLFACTORY RECEPTOR RESPONSES (EOG) OF FRESHWATER AND MARINE CATFISH TO AMINO ACIDS. *Can. J. Zool.* 58(10):1778-1784. Oct. 1980. In English with French summ. SFA 26(1)
[Dep. Zool. Physiol., La. State Univ., Baton Rouge 70803]

81-000374 Clavijo, I. E. TERRITORIALITY, MOVEMENTS AND DIURNAL MIGRATIONS IN THE REDBAND PARROTFISH, *SPARISOMA AUROFRENATUM* (VALENCIENNES). *Am. Zool.* 20(4):776. 1980. Abstract only. SFA 26(1)
[Dep. Mar. Sci., Univ. Puerto Rico, PR] The Redband parrotfish is a protogynous hermaphrodite, females mature in the size range of 100 to 110 mm SL and change sex at a larger size. Adults can be categorized in three socially distinct groups: territorial, wandering and migrating individuals. Territorial individuals include both sexes in an approximate ratio of five females to one male. Wandering individuals include thirty to forty percent of the total males found on the reef at any one time. They are smaller than territorial males and have a low reproductive success, but are capable of immediately taking over a vacated territory. Migratory individuals are active at dawn and dusk and have an average sex ratio of 19 females to one male. During the day, migrating individuals extend over the reef and do not make up a significant percentage of the total population. Data from observations, collections of individuals and field experimentation suggest the following sequence in the life history: migratory females sex reverse and become wandering males which in turn, become territorial males.

81-000375 Cole, H. W.; M. H. Figler; F. J. Parente and H. V. S. Peeke. THE RELATIONSHIP BETWEEN SEX AND AGGRESSION IN CONVICT CICHLIDS (*CICHLASOMA NIGROFASCIATUM* GÜNTHER). *Behaviour* 75(1/2):1-21. 1980. In English with German summ. SFA 26(1)
[Dep. Psychol., Towson State Univ., Towson, MD]

81-000376 Dubin, R. E. TWO TYPES OF COVER-SEEKING BEHAVIOR AT SUNSET BY THE PRINCESS PARROTFISH, *SCARUS TAENIOPTERUS*. *Am. Zool.* 20(4):789. 1980. Abstract only. SFA 26(1)
[Univ. Alberta, Edmonton, AB, Canada] Cover-seeking behavior in terminal phase male princess parrotfish was investigated at 4 study areas in Barbados. The males, which were permanently territorial during the day, either slept on their territories, or migrated 125-375m to sleeping spots within other males' territories. At ca. 25 minutes before sunset fish stopped feeding and began to search under coral heads, tailstand, and perform comfort movements. While migrators stopped chasing other males, sedentary fish continued until 10 minutes before sunset, the time when migrators arrived. Fish retired by 8 minutes after sunset. Sleeping spots, and most sedentary males' territories, were near the reef slopes and had dense coral cover, often *Acropora cervicornis*, factors which may deter nocturnal predators. Reverse migrations occurred at dawn. Migrations allow fish to exploit areas that lack

BEHAVIOR (CONTINUED)

81-000376 CONTINUED suitable sleeping spots, and illustrate the considerable behavioral flexibility of this species.

81-000377 Eaton, R. C. and C. B. Kimmel. DIRECTIONAL SENSITIVITY OF THE MAUTHNER CELL SYSTEM TO VIBRATIONAL STIMULATION IN ZEBRAFISH LARVAE. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 140(4):337-342. Dec. 1980. SFA 26(1)
[Dep. Environ. Popul. Organ. Biol., Univ. Colo., Boulder 80309]

81-000378 Eriksson, L.-O. and T. Van Veen. CIRCADIAN RHYTHMS IN THE BROWN BULLHEAD, *ICTALURUS NEBULOSUS* (TELEOSTEI). EVIDENCE FOR AN ENDOGENOUS RHYTHM IN FEEDING, LOCOMOTOR, AND REACTION TIME BEHAVIOUR. *Can. J. Zool.* 58(10):1899-1907. Oct. 1980. In English with French summ. SFA 26(1)
[Dep. Ecol. Zool., Univ. Umeå, S-901 87 Umeå, Sweden]

81-000379 Faber, D. J. OBSERVATIONS ON THE EARLY LIFE OF THE GOLDEN SHINER, *NOTEMIGONUS CRYSOLEUCAS* (MITCHILL), IN LAC HENEY, QUÉBEC. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 69-78. Sept. 1980. SFA 26(1)
[Natl. Mus. Nat. Sci., Ottawa, ON K1A 0M8, Canada] Larvae of golden shiners were observed in a lake in Québec, Canada, from 17 June through 18 August 1979, when they appeared to be the dominant larvae in shallow bulrush bays. Golden shiners started their life in shallow water and moved progressively into deeper water as they grew. Small larvae (5 to 10 mm) were observed in the hyponeustonic zone, at the water's edge, and in deeper water with older larvae. After a length of about 10 mm, they developed schooling aggregations that remained stationary among emergent macrophytes in slightly deeper water. At an average length of 30 mm, golden shiners left the shallow littoral region and took up residence offshore among submerged macrophytes. It is suggested that the stationary aggregations of golden shiner larvae in littoral areas contribute toward ecologic isolation.

81-000380 French. D. P. CLEANING BEHAVIOR IN SUNFISH HYBRIDS UNDER LABORATORY CONDITIONS. *Copeia* 1980(4):869-870. 5 Dec. 1980. SFA 26(1)
[Dep. Biol., Indiana Univ., Bloomington 47401]

81-000381 Garrett, T. L. CLOSE ENCOUNTERS OF A FORCED KIND: EXPERIMENTAL EVIDENCE FOR SHELTER DEFENSE BY THE TREEFISH, *SEBASTES SERRICEPS*. *Am. Zool.* 20(4):790. 1980. Abstract only. SFA 26(1)
[Calif. State Univ., Long Beach]

81-000382 Gibson, R. J. BEHAVIOURAL INTERACTIONS BETWEEN COHO SALMON (*ONCORHYNCHUS KISUTCH*), ATLANTIC SALMON (*SALMO SALAR*), BROOK TROUT (*SALVELINUS FONTINALIS*) AND STEELHEAD TROUT (*SALMO GAIRDNERI*), AT THE JUVENILE FLUVIATILE STAGES. *Am. Zool.* 20(4):953. 1980. Abstract only. SFA 26(1)
[Can. Fish. Oceans, St. John's, NF, Canada] Steelhead trout and Atlantic salmon were the most aggressive species. Steelhead were the most aggressive, and able to displace any of the other species, of similar or slightly larger size, from preferred locations. Brook trout and coho were the least aggressive and least territorial of the four species. Both species were more mobile than Atlantic salmon or steelhead. Dominance was based to a large extent on size. In all experiments the dominant species showed the best growth. Morphological and behavioural characteristics probably favour Atlantic salmon parr over the other three species in shallow fast water. Severe competition might be expected between Atlantic salmon parr and

BEHAVIOR (CONTINUED)

81-000382 CONTINUED juvenile steelhead trout, both riffle dwellers, and between coho and small brook trout, both predominantly found in the pool environment.

81-000383 Gibson, R. N. A QUANTITATIVE DESCRIPTION OF THE BEHAVIOUR OF WILD JUVENILE PLAICE (*PLEURONECTES PLATESSA* L.). *Anim. Behav. (Baillière Tindall, Publ.)* 28(4):1202-1216. Nov. 1980. SFA 26(1)
[Dunstaffnage Mar. Res. Lab., Oban, Scotland] The behaviour of young plaice (*Pleuronectes platessa* L.) as they migrate up and down sandy beaches with the tide is described. Their behaviour during this migration consists mainly of swimming and feeding interspersed with rarer behavioural acts. Over short periods swimming behaviour can be described by a random model in which the probability of a swim occurring remains constant. This probability varies markedly, however, from hour to hour. Two types of swimming movement are recognized: one of very short duration represents searching for food and the other, longer, category serves to transport the fish up and down the shore. Variations in the feeding rate and in the frequency, duration, and direction of swimming movements over the tidal cycle are described and related to the changing physical and biological conditions that the fish experience during their intertidal movements.

81-000384 Gorlick, D. L. INGESTION OF HOST FISH SURFACE MUCUS BY THE HAWAIIAN CLEANING WRASSE, *LABROIDES PHTHIROPHAGUS* (LABRIDAE), AND ITS EFFECT ON HOST SPECIES PREFERENCE. *Copeia* 1980(4):863-868. 5 Dec. 1980. SFA 26(1)
[Dep. Biol., Princeton Univ., Princeton, NJ 08540] Radio-tracer studies demonstrate that *Labroides phthirophagus* ingests considerable amounts of mucus from the surfaces of its hosts. Analysis of the quantity and gross chemical composition of host mucus reveals species specific differences. Host species preference order is roughly correlated to mucus characteristics. Host mucus probably serves as a reliable energy source for *Labroides* spp. cleaners, and may be important in determining their preference for different host species, especially when few ectoparasites are available.

81-000385 Grillner, S. and P. Wallén. DOES THE CENTRAL PATTERN GENERATION FOR LOCOMOTION IN LAMPREY DEPEND ON GLYCINE INHIBITION? *Acta Physiol. Scand.* 110(1):103-105. Sept. 1980. SFA 26(1)
[Dep. Physiol. III, Lidingövägen 1, Karolinska Inst. S11433 Stockholm, Sweden]

81-000386 Hayase, S. and S. Tanaka. HABITAT AND DISTRIBUTION OF THREE SPECIES OF EMBIOTOCID FISHES IN THE *ZOSTERA MARINA* BELT OF ODAWA BAY. *Bull. Jpn. Soc. Sci. Fish.* 46(8):955-962. Aug. 1980. SFA 26(1)
[Ocean Res. Inst., Univ. Tokyo, Nakano-ku, Tokyo 164, Japan]

81-000387 Hill, L. G. and W. J. Matthews. TEMPERATURE SELECTION BY THE DARTERS *ETHEOSTOMA SPECTABILE* AND *ETHESOTOMA RADIOSUM* (PISCES: PERCIDAE). *Am. Midl. Nat.* 104(2):412-415. Oct. 1980. SFA 26(1)
[Dep. Zool., Univ. Okla., Norman 73019] Temperature perference of darters (*Etheostoma*) in laboratory thermal gradients is reported for the first time. *Etheostoma spectabile* from Blue River, Oklahoma, varied less in laboratory temperature selection than did *Etheostoma radiosum* from the same stream. Changes in acclimation temperature altered thermal preference of *E. radiosum* more than that of *E. spectabile*. Differences in the response of the two species in laboratory thermal gradients suggest that *E. spectabile* actively selected a particular thermal regime, while *E. radiosum* merely moved to avoid thermal extremes. Differences in

BEHAVIOR (CONTINUED)

81-000387 CONTINUED thermoselection by the species can be related to differences in thermal stability of their microhabitats in the natural stream.

81-000388 Johnsen, P. B. and J. H. Teeter. SPATIAL GRADIENT DETECTION OF CHEMICAL CUES BY CATFISH. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 140(2):95-99. Nov. 1980. SFA 26(1)
[Monell Chem. Sens. Cent., 3500 Market St., Philadelphia, PA 19104]

81-000389 Johnsen, P. B. and A. D. Hasler. THE USE OF CHEMICAL CUES IN THE UPSTREAM MIGRATION OF COHO SALMON, *ONCORHYNCHUS KISUTCH* WALBAUM. *J. Fish Biol.* 17(1):67-73. July 1980. SFA 26(1)
[Monell Chem. Senses Cent., 3500 Market St., Philadelphia, PA 19104] The migratory behaviour of coho salmon was studied in the field. Coho salmon, *Oncorhynchus kisutch*, exposed to synthetic odours in a hatchery and released into Lake Michigan as juveniles, were recaptured as migrating adults 18 months later. The movements of 43 individuals were followed in experiments examining the role of imprinted chemical cues in the homing migration. Movements in relation to controlled distributions of the imprinting odours revealed that chemcial cues are used by the salmon in their upstream migration. Acting with the rheotactic response, fish were guided upstream by imprinting odours simulating their homestream. Coho salmon, in the absence of their imprinting odour, respond negatively to the current. Differential responses to current appear to serve in segregating fish imprinted to odours of different homestreams.

81-000390 Johnson, F. N. EFFECTS OF LITHIUM CHLORIDE ON LATERAL LINE RESPONSES IN *CARASSIUS AURATUS*. *Naturwissenschaften* 67(1):515-516. Oct. 1980. SFA 26(1)
[Dep. Psychol., Lancaster Univ., Bailrigg, Lancaster LA1 4YF, England]

81-000391 Johnstone, A. D. F. THE DETECTION OF DISSOLVED AMINO ACIDS BY THE ATLANTIC COD, *GADUS MORHUA* L. *J. Fish Biol.* 17(2):219-230. Aug. 1980. SFA 26(1)
[D.A.F.S. Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] A classical conditioning technique was employed with cod, *Gadus morhua* L., to determine thresholds for the detection of the L-forms of some α amino acids which are thought to be attractants or feeding stimulants for fish. The amino acids investigated, in order of effectiveness, were tyrosine, cysteine, phenylalanine, glycine and methionine with mean threshold response levels ranging from 2.5×10^{-8}M to 7.4×10^{-8}M. Histidine and lysine resulted in similar thresholds with a mean value of approximately 3×10^{-7}M while taurine and leucine were least effective with mean threshold levels of 2.1×10^{-6}M and 2.1×10^{-5}M respectively. Comparison is made with electrophysiological and behavioural response data from other species. The effect of raising the backgound level of glycine on the threshold to glycine for cod is described. The results are discussed with reference to data on levels of dissolved free amino acids in shallow sea waters which may have a bearing on determining chemosensory threshold levels. To detect a specific amino acid against a background level of the same substance the difference in level for detection is proportionally greater for higher background concentrations.

81-000392 Kavaliers, M. and C. L. Ralph. ANNUAL VARIATIONS IN THE EFFECTS OF PINEALECTOMY ON THE BEHAVIOURAL THERMOREGULATION OF WHITE SUCKERS. *Am. Zool.* 20(4):732. 1980. Abstract only. SFA 26(1)
[Dep. Zool., Colo. State Univ., Fort Collins 80523]

BEHAVIOR (CONTINUED)

81-000393 Kavaliers, M. CIRCADIAN ORGANIZATION IN WHITE SUCKERS *CATOSTOMUS COMMERSONI*: THE ROLE OF THE PINEAL ORGAN. *Comp. Biochem. Physiol. A Comp. Physiol.* 68(1):127-129. 1981. SFA 26(1)
[Dep. Zool., Univ. West. Ontario, London, ON N6A 5B7, Canada] Pinealectomy of the white sucker, *Catostomus commersoni*, had significant effects on the free-running circadian rhythm of locomotor activity. With fish kept under constant darkness pinealectomy resulted in a significant alteration in period length and decrease in the precision of circadian activity. In a number of cases circadian activity was split into two components that free-ran independently. The pineal organ is suggested to function in the coupling of a multi-oscillator system making up circadian organization in this fish.

81-000394 Kavaliers, M. RETINAL AND EXTRARETINAL ENTRAINMENT ACTION SPECTRA FOR THE ACTIVITY RHYTHMS OF THE LAKE CHUB, *COUESIUS PLUMBEUS*. *Behav. Neural Biol.* 30(1):56-67. Sept. 1980. SFA 26(1)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] The roles of retinal, pineal, and other extraretinal photoreceptors in determining light responses and the entrainment of circadian locomotor activity rhythms were investigated with a cyprinid fish, the lake chub, *Couesius plumbeus*. Determinations were made of the action spectra for inducing activity responses and entraining circadian activity. In normal, intact fish entrainment occurred over 368 to 742 nm with maximal sensitivity at wavelength bands centered at 538 to 568 nm ($1/10^6$-$1/10^4$ $\mu w/cm^2$. In blinded and blinded-pinealectomized fish extraretinal photoreception and entrainment was restricted to approximately 568 to 742 nm. In all cases the energy fluence rates for entraining activity were significantly greater than than those required for effecting activity responses.

81-000395 Kawamura, G. and S. Hara. [THE OPTOMOTOR REACTION OF MILKFISH LARVAE AND JUVENILES.] *Bull. Jpn. Soc. Sci. Fish.* 46(8):929-932. Aug. 1980. SFA 26(1)
[Lab. Fish. Technol., Fac. Fish., Kagoshima 890, Japan]

81-000396 Lee, L. W. and C. F. Herreid II. PERFORMANCE AND EFFICIENCY OF FAST-START ACCELERATION IN RAINBOW TROUT. *Am. Zool.* 20(4):910. 1980. Abstract only. SFA 26(1)
[St. George's Univ., Sch. Med., Dep. Biol. Sci., SUNY, Buffalo, NY]

81-000397 Levine, J. S. and E. F. MacNichol, Jr. COLOR VISION AND EVOLUTION IN TELEOST FISHES. *Am. Zool.* 20(4):887. 1980. Abstract only. SFA 26(1)
[Boston Coll., Chesnut Hill, MA]

81-000398 Lewis, D. S. C. MIXED SPECIES BROODS IN LAKE MALAWI CICHLIDS: AN ALTERNATIVE TO THE CUCKOO THEORY. *Copeia* 1980(4):874-875. 5 Dec. 1980. SFA 26(1)
[Fish. Res. Unit, P.O. Box 27, Monkey Bay, Malawi]

81-000399 McKaye, K. R. and M. K. Oliver. GEOMETRY OF A SELFISH SCHOOL: DEFENCE OF CICHLID YOUNG BY BAGRID CATFISH IN LAKE MALAWI, AFRICA. *Anim. Behav. (Baillière Tindall, Publ.)* 28(4):1287. Nov. 1980. SFA 26(1)
[Dep. Biol., Peabody Mus., Yale Univ., New Haven, CT 06511]

81-000400 Meliska, C. J. and J. A. Meliska and H. V. S. Peeke. THE RELATIONSHIP OF MIRROR-ELICITED DISPLAY TO COMBAT BEHAVIORS IN *BETTA SPLENDENS*. *Behav. Neural Biol.* 30(2):207-217. Oct. 1980. SFA 26(1)

BEHAVIOR (CONTINUED)

81-000400 CONTINUED
[Monmouth Coll., Monmouth, IL 61462] Thirty-eight male *Betta splendens* were screened to identify individuals exhibiting either high or low levels of reactivity to a mirror. Fish which displayed at the mirror for short durations were matched for combat with either (a) other short-duration displayers (the Short-Short group; *N* = six pairs), or (b) long-duration displayers (the Long-Short group; *N* = seven pairs). In combat, Short-Short pairs fought less intensely than Long-Short pairs; but within Long-Short pairs, short- and long-duration displayers did not differ in combat vigor. Correlations between combat behaviors and precombat mirror display measures tended to be positive, but were mostly small and nonsignificant. Correlations with postcombat mirror displays were greater. Results imply that mirror-elicited threat behaviors provided a partial predictor of actual combat aggression in *Betta*.

81-000401 Myrberg, A. A., Jr. FISH BIO-ACOUSTICS: ITS RELEVANCE TO THE 'NOT SO SILENT WORLD'. *Environ. Biol. Fishes* 5(4):297-304. 8 Dec. 1980. SFA 26(1)
[Rosentiel Sch. Mar. Atmos. Sci., Univ. Miami, 4600 Rickenbacker Causeway, Miami, FL 33149]

81-000402 Myrberg, A. A., Jr. and J. Y. Spires. HEARING IN DAMSELFISHES: AN ANALYSIS OF SIGNAL DETECTION AMONG CLOSELY RELATED SPECIES. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 140(2):135-144. Nov. 1980. SFA 26(1)
[Rosenstiel Sch. Mar. Atmos. Sci., Univ. Miami, 4600 Rickenbacker Causeway, Miami, FL 33149]

81-000403 Nash, R. D. M. LABORATORY OBSERVATIONS ON THE BURROWING OF THE SNAKE BLENNY, *LUMPENUS LAMPRETAEFORMIS* (WALBAUM), IN SOFT SEDIMENT. *J. Fish Biol.* 16(6):639-648. June 1980. SFA 26(1)
[Univ. Mar. Biol. Stn., Millport, Isle of Cumbrae, Scotland] The *Lumpenus lampretaeformis* used in this study were caught on soft sediments in Irvine Bay and Ardmucknish Bay (West Coast of Scotland). In aquaria the fish is capable of constructing and maintaining its own burrow in soft sediments. The burrow has a 'Y' configuration which may be made complex by the construction of additional tunnels as the original system begins to decay. The cross sections of these burrows are distinctive in that they have an oval shape in the main tunnel and a rounded cross section in the subsidiary (side) tunnel. Burrowing can be relatively rapid, a burrow with three entrances being constructed within 12 h.

81-000404 Nashimoto, K. [THE MAXIMUM SWIMMING FORCE OF RAINBOW TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 46(8):949-954. Aug. 1980. In Japanese with English summ. SFA 26(1)
[Fac. Fish., Hokkaido Univ., Minato, Hakodate 041, Japan]

81-000405 Neuman, E. ACTIVITY OF PERCH, *PERCA FLUVIATILIS* L., AND ROACH, *RUTILUS RUTILUS* (L.), IN A BALTIC BAY, WITH SPECIAL REFERENCE TO TEMPERATURE. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 107-125. 1979. SFA 26(1)
[Res. Dep., Natl. Swedish Environ. Prot. Bd., S-740 71 Öregrund, Sweden]

81-000406 Neuman, E. CATCH/TEMPERATURE RELATIONSHIP IN FISH SPECIES IN A BRACKISH HEATED EFFLUENT. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 88-106. 1979. SFA 26(1)

BEHAVIOR (CONTINUED)

81-000406 CONTINUED
[Res. Dep., Natl. Swedish Environ. Prot. Bd., S-740 71 Öregrund, Sweden]

81-000407 Pitcher, T. J. SOME ECOLOGICAL CONSEQUENCES OF FISH SCHOOL VOLUMES. *Freshwater Biol.* 10(6):539-544. Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Coll. North Wales, Bangor, Wales] Two consequences of a recently published method of calculating fish school volumes are examined in the light of ecological population data. First, minnow and roach schools occupy only about 0.01% of the volume of water in which they live, graphically illustrating the vagaries of field sampling, and providing reference values for foraging studies. Secondly, I show that roach schools in one river are constantly within attack range of pike predators. If this situation is general, theories which assume that schools function strategically merely to reduce the probability of encountering a predator, break down, whereas my predictions suggest that there is strong selection for direct predator evasion tactics in schools.

81-000408 Reynolds, W. W. and M. E. Casterlin. THERMOREGULATORY BEHAVIOR OF JUVENILE *CROMILEPTES ALTIVELIS* (SERRANIDAE), A TROPICAL MARINE FISH. *Hydrobiologia* 75(3):281-282. 6 Nov. 1980. SFA 26(1)
[Mar. Biol. Prog., Cent. Life Sci., Univ. New England, Biddeford, ME 04005] Ten juvenile *Cromileptes altivelis* were tested individually for 3-day periods in electronic shuttleboxes to measure their thermoregulatory behavior. The fish voluntarily occupied a 21-27°C span, out of a potentially available 0-50°C range. The mean final thermal preferendum was 24.5°C for all individuals. The thermoregulatory performance of this species is similar to that of cool temperate freshwater fishes.

81-000409 Rittgers, N. G. COMPARATIVE MORPHOLOGY OF SOUND PRODUCING MECHANISMS IN TWO SPECIES OF OPHIDIID FISHES. *M.S. thesis, Fla. Atl. Univ.* 76p. 1980. From Masters Abstr. 18(4):266. Dec. 1980. SFA 26(1)

81-000410 Ross, B. D.; T. P. Quinn; G. Lucchetti and E. L. Brannon. GENETIC AND ENVIRONMENTAL FACTORS IN THE COMPASS ORIENTATION OF SOCKEYE SALMON FRY. *Am. Zool.* 20(4):762. 1980. Abstract only. SFA 26(1)
[Univ. Wash., Seattle] The directional movement patterns of sockeye salmon (*Oncorhynchus nerka*) fry from the Weaver Creek - Harrison Lake population were tested in 4-armed tanks. The fry displayed an apparently innate northerly orientation, appropriate for their future lake migration. The orientation was not learned from the river migration experienced prior to testing. This orientation could be enhanced by the passage of time or the odors of the lake. This study complements others done on the olfactory and rheotactic responses of sockeye fry, and provides further evidence that the fry migrations are based on stock-specific responses to environmental cues.

81-000411 Schwarz, A. L. SOUND PRODUCTION AND ASSOCIATED BEHAVIOR IN A CICHLID FISH, *CICHLASOMA CENTRARCHUS*. II. BREEDING PAIRS. *Environ. Biol. Fishes* 5(4):335-342. 8 Dec. 1980. SFA 26(1)
[Div. Sci., Univ. New Brunswick, St. John, NB E2L 4L5, Canada] Pairs of *Cichlasoma centrarchus* were observed daily in the laboratory. Both males and females made sounds during breeding cycle but all sounds were aggressive in context; no sounds were heard to accompany courtship. Males made more sounds before spawning than afterwards and these were associated with territorial defense and with establishment of dominance over the female. Females produced more sounds after spawning than before, most in the context of brood defense but some toward the male during pre-spawning nest preparation. Prior to spawning, the number of sounds made by the males toward

BEHAVIOR (CONTINUED)

81-000411 CONTINUED their mates increased but the aggressive actions accompanying them became less intense. No such inverse correlation of agonistic intensity with number of sounds made was found for the females. From this study and earlier ones by the author it was concluded that sound in this species is a threat display which 1) provides an expression for agonism alternative to the performance of actions which could injure the female or drive her away, and 2) lessens the risk of injury to male or female during territory or brood defense.

81-000412 Stauffer, J. R., Jr.; E. L. Melisky and C. H. Hocutt. TEMPERATURE PREFERENCE OF THE NORTHERN REDBELLY DACE, *PHOXINUS EOS* (COPE). *Arch. Hydrobiol.* 90(1):121-126. 1980. In English with German summ. SFA 26(1)

[Appalachian Environ. Lab., Gunter Hall, Frostburg, MD 21532] The temperature preference of the northern redbelly dace was investigated in a horizontal thermal gradient. Fish were collected in Michigan and shipped via air express to the test facilities at Frostburg, Maryland. Fish were acclimated to 6, 12, 18, 24, 30 and 33°C (± 0.5°C). The relationship between preference temperature and acclimation temperature was best explained by the model: $P = 1.152A - 0.017 A^2 + 7.03$, where P is equal to the preference temperature and A the acclimation temperature. The final temperature preferendum was determined to be 25.3°C.

81-000413 Teeter, J. PHEROMONE COMMUNICATION IN SEA LAMPREYS (*PETROMYZON MARINUS*): IMPLICATIONS FOR POPULATION MANAGEMENT. *Can. J. Fish. Aquatic Sci.* 37(11):2123-2132. Nov. 1980. In English with French summ. SFA 26(1)

[Monell Chem. Senses Cent., Philadelphia, PA 19104]

81-000414 Tooker, C. P. and R. J. Miller. THE ONTOGENY OF AGONISTIC BEHAVIOUR IN THE BLUE GOURAMI, *TRICHOGASTER TRICHOPTERUS* (PISCES, ANABANTOIDEI). *Anim. Behav. (Baillière* Tindall, Publ.) 28(4):973-988. Nov. 1980. SFA 26(1)

[R. J. Miller: Sch. Biol. Sci., Okla. State Univ., Stillwater 74074]

81-000415 Townsend, D. R. INTRASPECIFIC VISUAL COMMUNICATION IN THE CICHLID FISH *TILAPIA MARIAE* BOULENGER. *Ph.D. dissertation, Univ. New Brunswick (Canada)* 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1619. Nov. 1980. SFA 26(1)

LIFE HISTORY-GENERAL WORKS

81-000416 Amanov, A. A. and Sh. Kh. Khakimova. THE AMU-DAR TROUT, *SALMO TRUTTA OXIANUS* OF NUREK RESERVOIR AND THE UPPER REACHES OF VAKHSH RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):45-50. 1979. SFA 26(1)

[Ye. N. Pavlovsky Inst. Zool. Parasitol., Tadzhik SSSR Acad. Sci., Dushanbe, USSR]

81-000417 Angelescu, V. ECOLOGIA TROFICA DE LA CABALLA DEL MAR ARGENTINO. (SCOMBRIDAE, *SCOMBER JAPONICUS MARPLATENSIS*). PART I. ALIMENTACION Y CRECIMIENTO. [TROPHIC ECOLOGY OF THE MACKEREL OF THE ARGENTINE CONTINENTAL SHELF. (SCOMBRIDAE, *SCOMBER JAPONICUS MARPLATENSIS*). PART I. FEEDING AND GROWTH.] *Rev. Invest. Desarrollo Pesq.* 1(1):5-44. 1979. In Spanish with English summ. SFA 26(1)

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000418 Barus, V.; J. Libosvárský and J. de la Cruz. OBSERVATIONS ON *LIMIA VITTATA* (POECILIIDAE) FROM KUBA. *Folia Zool.* 29(3):267-287. 1980. In English with Russian summ. SFA 26(1)
[Inst. Vert. Zool., Czech. Acad. Sci., Brno, Czechoslovakia]

81-000419 Beamish, F. W. H. BIOLOGY OF THE NORTH AMERICAN ANADROMOUS SEA LAMPREY, *PETROMYZON MARINUS*. *Can. J. Fish Aquatic Sci.* 37(11):1924-1943. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

81-000420 Beamish, R. J. ADULT BIOLOGY OF THE RIVER LAMPREY (*LAMPETRA AYRESI*) AND THE PACIFIC LAMPREY (*LAMPETRA TRIDENTATA*) FROM THE PACIFIC COAST OF CANADA. *Can. J. Fish. Aquatic Sci.* 37(11):1906-1923. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

81-000421 Bregazzi, P. R. and C. R. Kennedy. THE BIOLOGY OF PIKE, *ESOX LUCIUS* L., IN A SOUTHERN EUTROPHIC LAKE. *J. Fish Biol.* 17(1):91-112. July 1980. SFA 26(1)
[Univ. Reading, Dep. Agric. Horticult., Earley Gate, Reading RG6 2AT, England] The biology of pike, *Esox lucius* L., in a southern productive lowland lake is described. Scales and opercular bones were difficult to read and interpret, and growth estimated had perforce to be based on scale readings. Growth of Slapton pike is average and intermediate between recorded extremes. Both male and female pike reached maximum condition in February, just prior to spawning. The population of pike of over 450 mm fork length in the lake was estimated at 870.6 ± 389.3 in 1975, and 950.4 ± 143.3 in 1976/77. This leads to the conclusion that the pike population has one of the highest biomasses per surface area of water ever recorded. Number of pike per unit area of surface was also high, despite the fact that a significant proportion of the population (fish under 450 mm) could not be adequately sampled. Mean instantaneous mortality rate was 0.53, and mean instantaneous survival rate was 0.59. The roach provided the main item of diet of the pike, with perch taken less readily. Immature pike ate a significant proportion of invertebrates, but roach was again a common feature of the diet of even small fish. Two spawning migrations were identified; at other times of the year, pike were non territorial. The majority of pike spawned in March. Fecundity of a sample of females was assessed. Overall sex ratio was 1:1.

81-000422 Brewer, D. L. A STUDY OF NATIVE MUSKELLUNGE POPULATIONS IN EASTERN KENTUCKY STREAMS. *Ky. Dep. Fish Wildl. Resour. Bull.* No. 64. 107p. Oct. 1980. SFA 26(1)
Native populations of muskellunge (*Esox masquinongy ohioensis*) in eleven Kentucky streams were investigated during 1967-1971 in respect to the following: the size and structure of such populations; the minimum size of the musky at maturity; the time, places, and duration of musky spawning; the success of reproduction and the survival of young musky; the growth rate; and an evaluation of factors limiting musky populations. Musky were collected by use of electrofishing gear, sodium cyanide, and hoop nets. Musky were usually found to occur at rates of 1.5 to 2.0 pounds per acre of pool habitat. And population sampling showed that musky comprised 5.4% of the existing fish weight at such pools. Young-of-year musky generally occurred at a rate of about one fish per every 2.0 acres of pool habitat; sub-legal musky (10.5 to 29.9 inches) occurred at rates of about one per every 2.0 to 2.5 acres of pool habitat; and, legal musky occurred at rates of about one per every 12 to 14 acres of pool habitat. Musky in the streams generally spawned at Age IV. The average length of musky at Age IV was 29.4 inches, and the prevailing

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000422 CONTINUED 30-inch size limit protected most musky through their first spawning season. As far as could be determined, spawning took place at those shallow waters located at either the upper or lower ends of low-gradient pools. Musky began their initial pre-spawning movements near the end of March. Musky generally spawned during the last half of April or early May when water temperatures were averaging 55°-60°F. Adult musky made post-spawning movements and, by June, they were found as far as 12 miles from their spawning habitat. Growth in length as calculated by the Lee Method was 10.4 inches at Age I, 18.0 inches at Age II, 24.4 inches at Age III, 29.4 inches at Age IV, 32.7 inches at Age V, and 35.3 inches at Age VI. Tagging studies showed that about 33% of all tagged musky were creeled within a year after tagging. Prevailing springtime water temperatures and discharges evidently had a decided impact on musky reproduction success, with low discharges and seasonable temperatures during late April and early May being favorable, and high discharges and low temperatures during the same period being unfavorable. A number of collected musky were removed from the study streams for use as broodstock at a state hatchery. The final activity involved a determination of the amount of musky stream habitat present in the state. As of 1974, Kentucky had 14 streams with appreciable musky populations, and such streams provided about 6,600 acres of musky pool habitat. Several other streams had either small, remnant, or extinct musky populations. The available evidence indicated that considerable musky stream habitat in the state had been destroyed or degraded by the impoundment and/or pollution of musky streams. It was recommended that data from this investigation be used for the purpose of abating or litigating further encroachments on musky stream habitat. It was also recommended that most musky streams in the state receive maintenance stockings of large musky fingerlings. The recommended stocking rate for most musky streams was one fingerling per every two acres of pool habitat, but stocking rates for a few streams could be as high as one fingerling per acre of pool habitat. Maintenance stockings were recommended on the basis that certain environmental factors limit inherent musky recruitment at the streams.

81-000423 Chihuly, M. B. BIOLOGY OF THE NORTHERN PIKE, *ESOX LUCIUS* LINNAEUS, IN THE WOOD RIVER LAKES SYSTEM OF ALASKA, WITH EMPHASIS ON LAKE ALEKNAGIK. *M.S. thesis, Univ. Alaska* 122p. 1979. From Masters Abstr. 18(4):265. Dec. 1980. SFA 26(1)

This study sought basic biological information about northern pike of the Wood River Lakes system with emphasis on Lake Aleknagik, and focused on population structure, habitat, movement and food habits. Opercular bones were used for age and back-calculated growth determinations. Growth of pike was slow with the greatest increment occuring in the first year of life. After age 4+, growth remained constant at about 25 mm per year. Pike habitat was optimal when water was brown, relatively warm and shallow and contained dense stands of aquatic vegetation rooted in a muddy bottom. Less than five percent of the total surface area of the system included pike habitat. Pike homed to spawn in the spring and then remained relatively sedentary during summer months. The food of large pike (200-1,000 mm) consisted primarily of blackfish and threespine stickleback. Stickleback fry and mayfly nymphs were the most important foods of medium pike (50-199 mm).

81-000424 Dutil, J. D. and G. Power. COASTAL POPULATIONS OF BROOK TROUT, *SALVELINUS FONTINALIS*, IN LAC GUILLAUME-DELISLE (RICHMOND GULF) QUÉBEC. *Can. J. Zool.* 58(10):1828-1835. Oct. 1980. In English with French summ. SFA 26(1)

[Pêches Oceans, Gare Marit. Champlain, 901 Cap Diamont, 4e étage, Quebec G1K 7Y7, Canada] Brook trout grow slowly in coastal streams and resident fish average only 15.6 cm during their fourth summer. Anadromous fish move into brackish water at approximately 20 cm fork length. In the gulf, the modal age is 4+ and age groups 3+ to 6+ account for 80-90% of the

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000424 CONTINUED catch. Fish rapidly attain lengths of 35-40 cm, instantaneous growth in weight decreases from 1.27 for 2- to 3-year-old fish to 0.35 for 5- to 6-year-old fish. Dispersal from river mouths may be restricted to a distance of only 5-6 km. Late in July and throughout August, maturing fish of both sexes enter fresh water where ripening occurs. Movements at sea and duration of residence are controlled by salinity and temperature as influenced by maturation.

81-000425 Edwards, R. J. THE ECOLOGY AND GEOGRAPHIC VARIATION OF THE GUADALUPE BASS, *MICROPTERUS TRECULI*. *Ph.D. dissertation, Univ. Tex. (Austin)* 233p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1270. Oct. 1980. SFA 26(1)

The Guadalupe bass, *Micropterus treculi*, was studied throughout its range from March 1975 to December 1978. Although endemic to the streams draining the northern and eastern portions of the Edwards Plateau region of central Texas, introduced *M. treculi* populations were also found in the Nueces R. drainage. Meristic and morphometric analyses indicated a close relationship between populations of *M. treculi* and between *M. treculi* and *M. punctulatus*, its closest relative. Natural hybrids of *M. treculi* and introduced *M. dolomieui* were found and their implications on the genetic integrity of *M. treculi* are discussed. In their native streams, *M. treculi* appear to live only several years although specimens up to 6 years of age were found. Yearly survival rates calculated for *M. treculi*, *M. salmoides* and *M. punctulatus* encountered in the study area were essentially equal for all species. Most male *M. treculi* had mature gonads in their first year, most females in their second year. The breeding season of *M. treculi* is thought to be from about March to August or September with most spawning occurring in April to June. Females with mature ova varied in fecundity from 399-9286 ova. Egg diameters also varied and mature eggs had diameters between 1.50 and 2.25 mm. Other data on seasonal fat distribution and parasites encountered in *M. treculi* are also discussed.

81-000426 Edwards, R. R. C. ASPECTS OF THE POPULATION DYNAMICS AND ECOLOGY OF THE WHITE SPOTTED STINGAREE, *UROLOPHUS PAUCIMACULATUS* DIXON, IN PORT PHILLIP BAY, VICTORIA. *Aust. J. Mar. Freshwater Res.* 31(4):459-467. Sept. 1980. SFA 26(1)

[Mar. Sci. Lab., P.O. Box 114, Queenscliff, Victoria 3225, Australia] The ages of *U. paucimaculatus* are determined using sections of the centra of the vertebrae; as many as 10 age classes were present. Females grow to a greater length (57.3 cm) than males (42.8 cm) and live to a greater age. The sex ratio in the population is approximately unity. Parturition was observed in females 34 cm long, or 3 years of age. Fecundity is estimated as a maximum of 12 offspring per year for females older than 7 years. Biomass of the population appears to be higher in summer than in winter and suggests seasonal migration or changes in behaviour patterns in relation to trawls. The diet of juveniles consists primarily of amphipods and isopods, but that of adults consists mainly of polychaetes and caridean and brachyuran crustaceans.

81-000427 Fraser, J. M. SURVIVAL, GROWTH, AND FOOD HABITS OF BROOK TROUT AND F_1 SPLAKE PLANTED IN PRECAMBRAIN SHIELD LAKES. *Trans. Am. Fish. Soc.* 109(5):491-501. Sept. 1980. SFA 26(1)

[Ontario Minist. Nat. Resour., Fish. Br., Maple, ON L0J 1E0, Canada]

81-000428 Gibson, R. N. and I. A. Ezzi. THE BIOLOGY OF THE SCALDFISH, *ARNOGLOSSUS LATERNA* (WALBAUM) ON THE WEST COAST OF SCOTLAND. *J. Fish Biol.* 17(5):565-575. Nov. 1980. SFA 26(1)

[Dunstaffnage Mar. Res. Lab., Oban, Argyll, Scotland] The biology of a Scottish population of the small bothid flatfish, *Arnoglossus laterna*, was studied from January 1975 until September 1976. The data were taken from

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000428 CONTINUED monthly samples totalling over 500 fish trawled in 18-36 m on a soft mud bottom. Otoliths were used for age determination and a growth curve was constructed which showed that most growth occurs in the first 2-3 years of life. The maximum age recorded was 8+ years. The fish first mature sexually in their second year at a standard length of 6-7 cm and the short spawning season lasts from the late June to August. Fecundity is length-dependent and the relationship could be described by the regression equation: log fecundity = 3.3472 log standard length (mm) - 2.1064. The diet consists mainly of decapod crustaceans (particularly crangonid shrimps), polychaetes, mysids and small fish.

81-000429 Golden, J. T.; R. L. Demory and W. H. Barss. ABUNDANCE, SIZE AND AGE COMPOSITION, AND GROWTH OF PACIFIC OCEAN PERCH, *SEBASTES ALUTUS*, SAMPLED DURING 1977. *Mar. Fish. Rev.* 42(3-4):41-47. Mar.-Apr. 1980. SFA 26(1)
[Oreg. Dep. Fish Wildl. Res. Lab., Marine Science Dr., Newport 97365]

81-000430 Hanson, J.M. and S. U. Qadri. OBSERVATIONS ON THE BIOLOGY OF BLACK CRAPPIE, *POMOXIS NIGROMACULATUS* (LESUEUR), IN THE OTTAWA RIVER. *Nat. Can. (Que.)* 107(1):35-42. 1980. In English with French summ. SFA 26(1)
[Dep. Biol., Univ. Ottawa, Ottawa, ON K1N 6N5, Canada] Black crappie, *Pomoxis nigromaculatus* (Lesueur), grew to a size of 315 mm in total length, 507 g, and an age of 8 + in the Ottawa River. The length-weight relationship was log WT = 3.049 log TL - 4.912. The average Fulton's condition factor (TL) was 1.60. Ottawa River black crappie matured as early as age 2+. The gonadosomatic index averaged 3.3% for females of ages 5+ to 8+ and 0.52% for males of ages 4+ to 8+. Dipteran larvae were the dominant food eaten by black crappie of 61 to 110 mm in total length and fish larger than 110 mm were piscivorous.

81-000431 Hastings, P. A. and S. A. Bortone. OBSERVATIONS ON THE LIFE HISTORY OF THE BELTED SANDFISH, *SERRANUS SUBLIGARIUS* (SERRANIDAE). *Environ. Biol. Fishes* 5(4):365-374. 8 Dec. 1980. SFA 26(1)
[Fac. Biol., Univ. West Fla., Pensacola 32504] The biology of *Serranus subligarius*, a typical inhabitant of low limestone reef outcroppings and artifical reefs from North Carolina to Florida and in the northern Gulf of Mexico, was studied on inshore jetties in the northeastern Gulf of Mexico from February 1974 to April 1975. The length-weight relationship was expressed by the equation $W = 0.000006L^{3.431}$. Growth was greatest in the first year (43.5 mm SL) and declined in the remaining three years of life (17.3, 10.5, and 7.1, respectively). In individuals larger than 40 mm SL, gammaridean and caprellid amphipods were the most numerous food items but crabs, shrimp, and fishes were the most important food items by weight. In individuals less than 40 mm SL, copepods were the numerous food item, but gammaridean amphipods and shrimp were the most important items by weight. Two incidents of cannibalism were recorded. The ovotestis of the belted sandfish is composed of two lobes which are broadly united posteriorly, with the testicular tissue restricted to a broad band encircling the posterior region of the gonad. Age-group 1 fish are functional synchronous hermaphrodites. Testicular tissure matures in the fall or winter of a fish's first year (all specimens examined histologically, including those from the nonspawning season, contained flagellated spermatozoa) while ovarian tissue matures in the following spring. Spawning season in 1974 extended from late April or early May to September. Crossfertilization is the usual reproductive mode, although individuals are capable of selffertilization.

81-000432 Hayase, S. and S. Tanaka. GROWTH AND REPRODUCTION OF THREE SPECIES OF EMBIOTOCID FISHES IN THE *ZOSTERA MARINA* BELT OF ODAWA BAY. *Bull. Jpn. Soc. Sci. Fish.* 46(9):1089-1096. Sept. 1980. SFA 26(1)
[Ocean Res. Inst., Univ. Tokyo, Nakano, Tokyo 164, Japan]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000433 Heath, K. L. I. COMPARATIVE LIFE HISTORIES OF TWO SPECIES OF ANCHOVIES, *ANCHOA DELICATISSIMA* AND *A. COMPRESSA* (F. ENGRAULIDAE), FROM NEWPORT BAY, CALIFORNIA. *M.A. thesis, Calif. State Univ. (Fullerton)* 80p. 1980. From Masters Abstr. 18(4):272. Dec. 1980. SFA 26(1)

81-000434 Hess, L. and C. Heartwell. LITERATURE REVIEW OF LARGE ESOCIDS (MUSKELLUNGE, NORTHERN PIKE, HYBRID TIGER MUSKELLUNGE). *Proc. Warm Water Workshop Northeast Div. Am. Fish Soc.* 10:139-181. 1977(1979). SFA 26(1)
[W. Va. Dep. Nat. Resour., Elkins 26133]

81-000435 Jones, G. P. CONTRIBUTION TO THE BIOLOGY OF THE REDBANDED PERCH, *ELLERKELDIA HUNTII* (HECTOR), WITH A DISCUSSION ON HERMAPHRODITISM. *J. Fish Biol.* 17(2):197-207. Aug. 1980. SFA 26(1)
[Univ. Auckland, Mar. Lab., R.D. Leigh, Auckland, New Zealand] The presence of oocytes in the testes of several males indicates that the redbanded perch *Ellerkeldia huntii* exhibits protogynous hermaphroditism. All males appear to be secondary in origin; however the structure of the testes differ from most other protogynous serranids. In samples collected from the Poor Knights Is., New Zealand, males outnumbered females 2.7:1 (n=52). The numbers in each sex were equal until a length of 100-110 mm, after which the male proportion increased to 100%. The oldest female was aged 2+ years, whereas males were found as old as 5+ years. There were no colour differences associated with sex. The mean testes weight was only 7% of the mean ovary weight. Both sexes grew at the same rate. Observations during December indicated that although many individuals were solitary, some were paired. The larger individuals of pairs were males, the smaller females. Individuals foraged in the algal canopy on gammarid amphipods and mysid shrimps. The average range of movements was only 2.2 m^2.

81-000436 Koehler, F. E. LIFE HISTORY STUDIES OF THE LONGNOSE SUCKER, *CATOSTOMUS CATOSTOMUS*, AND THE WHITE SUCKER, *CATOSTOMUS COMMERSONI*, IN NEARSHORE EASTERN LAKE MICHIGAN NEAR LUDINGTON, MICHIGAN. PART I. THE LIFE HISTORY OF THE LONGNOSE SUCKER, *CATOSTOMUS CATOSTOMUS*, IN NEARSHORE EASTERN LAKE MICHIGAN. PART II. THE LIFE HISTORY OF THE WHITE SUCKER, *CATOSTOMUS COMMERSONI*, IN NEARSHORE EASTERN LAKE MICHIGAN. *M.S. thesis, Mich. State Univ.* 64p. 1979. From Masters Abstr. 18(4):273. Dec. 1980. SFA 26(1)
Longnose suckers and white suckers taken with gill nets and trawls provided seasonal data on age, growth, maturity, fecundity, food habits and distribution. Ages of mature fish were best determined from sections of the pectoral fin rays, while ages of immature fish were best determined from scales. The growth rate of both species approached the fastest reported in previous investigations. Suckers generally matured faster and at larger sizes in Lake Michigan than in other waters. Regression equations were developed for fecundity vs. length and weight. Suckers are bottom feeders and the most important food items of both species were chironomids, cladocerans, and amphipods. Multiple regression analysis identified water temperature, depth, photoperiod, and substrate type as important factors in explaining longnose sucker gill net catches. Multiple regression analysis also identified water temperature, depth, photoperiod, light penetration, barometric pressure, and substrate type as factors significant in explaining white sucker catches.

81-000437 Kuliyev, Z. M. and Sh. M. Bagirova. PECULIARITIES OF THE DWARF POPULATION OF THE CASPIAN ROACH, *RUTILUS RUTILUS CASPICUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):51-55. 1979. SFA 26(1)
[Inst. Zool., Azerbaidzhn SSR Acad. Sci., Baku, USSR]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000438 Laroche, J. L. LARVAL AND JUVENILE ABUNDANCE, DISTRIBUTION, AND LARVAL FOOD HABITS OF THE LARVAE OF FIVE SPECIES OF SCULPINS (FAMILY: COTTIDAE) IN THE DAMARISCOTTA RIVER ESTUARY, MAINE. *Ph.D. dissertation, Univ. Me.* 175p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1607. Nov. 1980. SFA 26(1)

81-000439 Lenarz, W. H. SHORTBELLY ROCKFISH, *SEBASTES JORDANI*: A LARGE UNFISHED RESOURCE IN WATERS OFF CALIFORNIA. *Mar. Fish. Rev.* 42(3-4):34-40. Mar.-Apr. 1980. SFA 26(1)

[NMFS, 3150 Paradise Dr., Tiburon, CA 94920] Shortbelly rockfish, *Sebastes jordani*, appear to be abundant in California waters and present the potential for development of a new large fishery in the area. This paper contains: 1) A description of the biology of the species, 2) first approximations of the effect of fishing on the stock, 3) a review of the rockfish survey results with regard to fishing, 4) a review of the potential for development of a fishery, and 5) a discussion of management options for the fishery.

81-000440 Maitland, P. S. REVIEW OF THE ECOLOGY OF LAMPREYS IN NORTHERN EUROPE. *Can. J. Fish. Aquatic Sci.* 37(11):1944-1952. Nov. 1980. In English with French summ. SFA 26(1)

[Inst. Terrestrial Ecol., 78 Craighall Rd., Edinburgh, Scotland]

81-000441 Mann, R. H. K. THE GROWTH AND REPRODUCTIVE STRATEGY OF THE GUDGEON, *GOBIO GOBIO* (L.), IN TWO HARD-WATER RIVERS IN SOUTHERN ENGLAND. *J. Fish Biol.* 17(2):163-176. Aug. 1980. SFA 26(1)

[Freshwater Biol. Assoc., River Lab., East Stoke, Wareham, Dorset BH20 6BB, England] Scales from 682 gudgeon from the River Frome and 504 from the River Stour were used for age determinations. Growth in length was confined to the period May to October, but some weight increase occured during the winter because of gonad development. Growth rates in the two rivers were the same, and were higher than most of the those reported from other European rivers. Wide fluctuations, up to 12-fold, occurred in the year-class strengths of Frome gudgeon, caused by variations in the survival of juvenile gudgeon in their first year of life. Density-independent factors, particularly water temperature, were major influences. Female gudgeon grew marginally slower than the males, but they matured earlier and at a smaller size. They were fractional spawners but their total reproductive effort each season was high. Both sexes had low survival rates and their reproductive life spans were rarely more than three years. These life history traits support the premise that these gudgeon populations are *r*-selected.

81-000442 Mayden, R. L.; B. M. Burr and S. L. Dewey. ASPECTS OF THE LIFE HISTORY OF THE OZARK MADTOM, *NOTURUS ALBATER*, IN SOUTHEASTERN MISSOURI (PISCES: ICTALURIDAE). *Am. Midl. Nat.* 104(2):335-340. Oct. 1980. SFA 26(1)

[Mus. Nat. Hist., Univ. Kans., Lawrence 66045] Selected aspects of the life history of *Noturus albater* Taylor were studied from collections and observations made in southeastern Missouri. During the breeding season, there was sexual dimorphism in shape and size of the genital papillae and degree of development of head musculature. The number of mature ova averaged 111.6 in ripe females. Nesting sites were under large rocks where eggs were laid in a pit and guarded by the male. Clutch size averaged ca. 40 eggs; the eggs were 3.5 - 4.0 mm wide and adhered to each other in mass. *Notropis zonatus*, *Etheostoma caeruleum* and *Percina evides* were observed eating eggs and young. Under laboratory conditions eggs hatched in 196 hr at 25 C. Prehatchlings (6.0 mm TL) were mostly devoid of melanophores, had a large yolk sac and the maxillary barbels and pectoral fins were beginning to develop. By 7 days, larvae (11.8 mm TL) were well-pigmented, had barbels, fins and most fin rays developed, the yolk sac nearly absorbed and had the

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000442 CONTINUED appearance and body form essentially like that of an adult. Individuals of both sexes live at least 2+ years. Aquatic Diptera larvae (mostly midges) were the dominant food item of adults.

81-000443 McCart, P. J. A REVIEW OF THE SYSTEMATICS AND ECOLOGY OF ARCTIC CHAR, *SALVELINUS ALPINUS*, IN THE WESTERN ARCTIC. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 935. vii + 89p. July 1980. In English with French summ. SFA 26(1)

[Aquatic Environments Ltd., 1235A-40th Ave. N.E., Calgary, AB T2E 6M9, Canada]

81-000444 Overmann, G. J.; R. D. Hoyt and G. A. Kindschi. THE LARVAL LIFE HISTORY OF THE CRAPPIES (*POMOXIS*) SPP. *Trans. Ky. Acad. Sci.* 41(3-4):105-115. Sept. 1980. SFA 26(1)

[Dep. Biol., West. Ky. Univ., Bowling Green 42101] Carppies spawned in Rough River Lake from 29 April to 9 July 1978. Larvae were first collected on 3 May when the lake temperature reached 17 C. A total of 7,369 crappies was taken from 3 May to 1 August. Developmental patterns were described for specimens 4.75 to 29 mm total length. Meristic characteristics averaged 10.8 for preanal myomeres, 21.1 for postanal myomeres, 31.9 for total myomeres, and 0.62 for ratio of preanal to postanal length. Densities of larvae were low early in the spawning period and reached a maximum of 185/100 m^3 on 6 June, but decreased to 10/100 m^3 thereafter. Larvae less than 20 mm total length were taken mostly near the surface while larger specimens preferred deeper water. Growth averaged 3.1 mm per week for the 14-week study, 1.43 mm per week for the first 8 weeks, and 4.5 mm for the last 6 weeks. Major food items of early postlarvae were rotifers, copepod nauplii, and the cladoceran *Diaphanosoma* sp. Late postlarvae ingested larger food items including the cladocerans *Diaphanosoma* sp. and *Simocephalus* sp. and larval dipterans of the subfamily Chaoborinae. Juvenile food habits were similar to late postlarvae except for the addition of large numbers of *Bosmina* sp. Early postlarvae fed mostly during the night while late postlarvae and juveniles fed mostly during the day. Juvenile white crappies fed more near the bottom while juvenile black crappies fed mostly near the surface.

81-000445 Padrón, F. G.; A. P. Martínez and M. Prokeš. SPAWNING, EARLY DEVELOPMENT AND GROWTH OF LARGEMOUTH BASS IN CUBA. *Acta Sci. Nat. Brno* 14(4):5-24. 1980. In English with Russian summ. SFA 26(1)

[Inst. Zool., Acad. Ciencias Cuba, Rpto. Atabey, Playa, Havana, Cuba]

81-000446 Potter, I. C. ECOLOGY OF LARVAL AND METAMORPHOSING LAMPREYS. *Can. J. Fish. Aquatic Sci.* 37(11):1641-1657. Nov. 1980. In English with French summ. SFA 26(1)

[Sch. Environ. Life Sci., Murdoch Univ., Murdoch, Western Australia 6153, Australia]

81-000447 Power, M. E. DENSITY, BEHAVIOR, GROWTH AND SURVIVORSHIP OF ARMORED CATFISH IN A PANAMANIAN STREAM. *Am. Zool.* 20(4):880. 1980. Abstract only. SFA 26(1)

[Univ. Wash., Seattle] Four species of armored catfish (*Loricariidae*) graze periphyton in a Panamanian stream. Four lines of evidence suggest that their dispersion among stream pools of various productivities approach Fretwell's 'ideal free distribution'. Population density in these food-limited fish tracked algal productivity. A balance between growth rates of algae and depletion by grazing produced similar standing crops of

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000447 CONTINUED periphyton among pools. Growth rates of pre-reproductive individuals of the most common pool species did not differ among pools. Survivorship in this species was also indistinguishable among pools. Loricariids were able to establish this dispersion because riffle barriers between pool habitats were not insurmountable, because despotism was infeasible and because loricariids had the mobility, the memory and the decision-making capability to sample and chose among habitats in a changing environment.

81-000448 Sjöberg, K. ECOLOGY OF THE EUROPEAN RIVER LAMPREY (*LAMPETRA FLUVIATILIS*) IN NORTHERN SWEDEN. *Can. J. Fish. Aquatic Sci.* 37(11):1974-1980. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Wildl. Ecol., Fac. For., Swedish Univ. Agric. Sci., S90183 Umeå, Sweden]

81-000449 Walton, B. D. THE REPRODUCTIVE BIOLOGY, EARLY LIFE HISTORY AND GROWTH OF WHITE SUCKERS, *CATOSTOMUS COMMERSONI*, AND LONGNOSE SUCKERS, *C. CATOSTOMUS*, IN THE WILLOW CREEK-CHAIN LAKES SYSTEM, ALBERTA. *Alberta Dep. Energy Nat. Resour. Fish Res. Rep.* No. 23. May 1980. SFA 26(1)
The reproductive biology, early life history, and growth of white suckers, *Catostomus commersoni*, and longnose suckers, *C. catostomus*, in the Willow Creek-Chain Lakes system, Alberta, were studied from April 1975 to January 1977. Willow Creek, the largest of two tributaries to Chain Lakes reservoir, provides good spawning habitat for white suckers and longnose suckers. The spring spawning migration of white and longnose suckers began when stream temperature reached 10°C; thereafter, the rate of movement was influenced, to a degree, by discharge. Virtually all upstream and downstream movement occurred at night. Seasonal and diel movement were not associated with turbidity. During the peak of the spawning migration in May there were an estimated 11,390 white suckers and 773 longnose suckers in the lower 11 km of the stream. Tagged white suckers ascended the creek over 10.3 km; however, there was little evidence of population interchange between lower and upper reaches of the creek. Upstream migrant white suckers from upper and lower reaches of the creek, in May, were not greatly different in size or age. Longnose suckers were not captured in upper reaches of the creek. Spawning activity increased after upstream movement subsided in late May. Incubation times for white suckers and longnose suckers were 15 days ($\bar{x}$ temp. 10°C) and 14 days ($\bar{x}$ temp. 12.2°C) respectively. Larvae emerged from the gravel about 11 days after hatching and commenced drifting downstream. Larval drift occurred mainly at night and most fry (larvae) were captured near surface. Increased buoyancy, caused by initial inflation of the swim bladder, may have brought more fry into the upper part of the water column. Drifting fry had a mean length of 12.02 mm. Embryological development of white and longnose suckers was examined; however, no morphological differences were noted between species. Compared to other populations, white suckers were relatively slow growing, longnose suckers were not. After sexual maturity was reached in both species, females were larger than males of the same age. Cross sectioned pectoral fin rays were reliable for age determination and back calculation. The maximum ages of white and longnose suckers were XII and VIII respectively. Fish older than VI were rare in the sample. Differences in growth rates between the two species may be related to diet and competition for food. White and longnose suckers exhibited annual reproductive cycles which were reflected by seasonal changes in weight and histological appearance of the gonads. Spermatogenesis was virtually complete by November, but oogenesis lagged behind. Ovaries gained most of their weight by mid-winter and continued to develop gradually up to spawning time. Microscopically, ovaries from white suckers were similar to those of longnose suckers. One major difference was detected in tested of white suckers and longnose suckers; spermatozoa were oval in white suckers and spherical in longnose suckers. Fecundity of both species was relatively low, a fact that may be related to suboptimal habitat and over crowding in Chain Lakes reservoir.

LIFE HISTORY-GENERAL WORKS (CONTINUED)

81-000450 Waltz, W.; W. A. Roumillat and P. K. Ashe. DISTRIBUTION, AGE STRUCTURE, AND SEX COMPOSITION OF THE BLACK SEA BASS, *CENTROPRISTIS STRIATA*, SAMPLED ALONG THE SOUTHEASTERN COAST OF THE UNITED STATES. *S.C. Mar. Resour. Cent. Tech. Rep.* No. 43. 18p. Dec. 1979. SFA 26(1)
[S.C. Mar. Resour. Res. Inst., Charleston 29412]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

81-000451 Barton, L. H. and D. L. Steinhoff. ASSESSMENT OF SPAWNING HERRING (*CLUPEA HARENGUS PALLASII*) STOCKS AT SELECTED COASTAL WATERS IN THE EASTERN BERING SEA. *Alaska Dep. Fish Game Inf. Leafl.* No. 187. v + 60p. Oct. 1980. SFA 26(1)
[Alaska Dep. Fish Game, Div. Commer. Fish., Subport Bldg., Juneau 99801]

81-000452 Bonetto, C. A. DENSIDAD DE POBLACION, CRECIMIENTO Y PRODUCCION DEL SABALO (*PROCHILODUS PLATENSIS*) EN LA LAGUNA GONZALEZ (CORRIENTES, REPUBLICA ARGENTINA). [POPULATION DENSITY, GROWTH AND PRODUCTION OF THE "SÁBALO" (*PROCHILODUS PLATENSIS*) IN THE GONZÁLEZ POND (CORRIENTES, ARGENTINA).] *Hist. Nat.* 1(18):121-136. 1980. In Spanish with English summ. SFA 26(1)
[CECOAL, Plácido Martínez 1383, 3400 Corrientes, Argentina] This paper deals with the assessment of the population density, growth and production of the "sábalo" (*Prochilodus platensis*) in the González pond, a small, shallow and markedly eutrophic water body. The "sábalo" population (a typical migratory species) has been confined in this pond since the great flood of 1971/1972, during which the waters of the Riachuelo River invaded the pond. The population density has been assessed by means of mark-recapture methods, following JOLLY's (1965) model, in about 6,000 fishes in 1976. The fishes grew fast during their first two years in the pond, but they never exceeded a mean length of 36 cm, while in other larger ponds in the same basin or in the Riachuelo River itself, "sábalos" of more than 60 cm are not uncommon. According to such growth patterns, the yield was high, about 250 kg/ha/year in 1972/73, decreasing sharply during the following years. The harvestable fish production represents only 0.2 - 0.3% of the primary production, perhaps because of the specialized feeding habits of this mud-eater species.

81-000453 Dark, T. A.; M. O. Nelson; J. J. Traynor and E. P. Nunnallee. THE DISTRIBUTION, ABUNDANCE, AND BIOLOGICAL CHARACTERISTICS OF PACIFIC WHITING, *MERLUCCIUS PRODUCTUS*, IN THE CALIFORNIA-BRITISH COLUMBIA REGION DURING JULY-SEPTEMBER 1977. *Mar. Fish. Rev.* 42(3-4):17-33. Mar.-Apr. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] The results of a 1977 trawl-hydroacoustic survey of the distribution and abundance of Pacific whiting, *Merluccius productus*, off California, Oregon, Washington, and British Columbia are presented. Estimates of biomass are presented by International North Pacific Fisheries Commission (INPFC) statistical areas and depth strata. A total of 1,198,932 metric tons of Pacific whiting were estimated to be present in the survey area, 29.2 percent of which occurred in the INPFC Vancouver area; 29.1 percent in the Columbia area; 30.9 percent in the Eureka area; 10.5 percent in the Monterey area; and 0.2 percent in the Conception area. Only 5.8 percent of the total biomass was estimated by the bottom trawl survey while the remainder was estimated by the hydroacoustic-midwater trawl survey. Age and length compositions reflected previously established latitudinal stratification of age-size groups with the relative abundance of the older, larger fish increasing from south to north. There were no consistent trends of size or age with depth. Age data revealed a high relative abundance of 4-year-old Pacific whiting. This extraordinarily large

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

81-000453 CONTINUED 1973 year-class at least partially explains the more than twofold increase in estimated biomass between 1975 and 1977 resource surveys.

81-000454 Ebeling, A. W.; R. J. Larson; W. S. Alevizon and R. N. Bray. ANNUAL VARIABILITY OF REEF-FISH ASSEMBLAGES IN KELP FORESTS OFF SANTA BARBARA, CALIFORNIA. *NOAA Fish. Bull.* 78(2):361-377. Apr. 1980. SFA 26(1)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106]

81-000455 Gunderson, D. R. and W. H. Lenarz. COOPERATIVE SURVEY OF ROCKFISH AND WHITING RESOURCES OFF CALIFORNIA, WASHINGTON, AND OREGON, 1977: INTRODUCTION. *Mar. Fish. Rev.* 42(3-4):1. Mar.-Apr. 1980. SFA 26(1)
[Fish. Res. Inst., Univ. Wash., Seattle 98195]

81-000456 Gunderson, D. R. and T. M. Sample. DISTRIBUTION AND ABUNDANCE OF ROCKFISH OFF WASHINGTON, OREGON, AND CALIFORNIA DURING 1977. *Mar. Fish. Rev.* 42(3-4):2-16. Mar.-Apr. 1980. SFA 26(1)
[Fish. Res. Inst., Univ. Wash., Seattle 98195] The methods employed during the demersal (bottom trawling) phase of the 1977 rockfish survey and in obtaining catch and biological data during the demersal and pelagic (hydroacoustic-midwater) phases are outlined. Geographic and bathymetric trends in the abundance and species composition of the demersal rockfish community are discussed, and the results of the demersal and pelagic surveys are compared. Biomass estimates (50- to 250-fathom or 91- to 457-m depth zone) are given for the dominant rockfish species in each statistical area of the International North Pacific Fisheries Commission (INPFC). Canary rockfish, *Sebastes pinniger* (26,000 t), yellowtail rockfish, *S. flavidus* (23,000 t), and Pacific ocean perch, *S. alutus* (15,000 t), dominated the rockfish biomass in the Vancouver and Columbia INPFC areas. Rockfish biomass was low in the Eureka area (about 4,000 t in the 50- to 250-fathom zone) but increased again to the south. The rockfish biomass in the Monterey and Conception INPFC areas was dominated by shortbelly rockfish, *S. jordani* (320,000 t), splitnose rockfish, *S. diploproa* (10,000 t), chilipepper, *S. goodei* (9,000 t), stripetail rockfish, *S. saxicola* (7,000 t), and bocacio, *S. paucispinis* (6,000 t). Shortbelly rockfish were found to be principally pelagic in their distribution; less than 10 percent of the stock was encountered during the demersal survey. The percision of most biomass estimates for rockfish was relatively low because of the highly contagious spatial distribution characterizing most of the species.

81-000457 Harris, F. A.; L. M. Ager and E. Hayes. BARKLEY LAKE SYMPOSIUM. COMPARISON OF VARIOUS MARK-RECAPTURE TECHNIQUES FOR ESTIMATING ABUNDANCE OF LARGEMOUTH BASS IN BARKLEY LAKE, KENTUCKY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:703-709. 1979(1980). SFA 26(1)
[N.C. Wildl. Resour. Comm., Siler City 27344] Estimates of the number of largemouth bass (*Micropterus salmoides*) 153 mm and longer in Crooked Creek Bay made by mark-recapture techniques were conpared with rotenone estimates. Electrofishing was used to collect bass for marking, while electrofishing and angling provided recaptures. Estimates obtained by Petersen and Schnabel method generally were lower than rotenone estimates. Both methods estimated the number of intermediate-size bass more accurately than adult bass. Size distributions of bass captured by angling, electrofishing, and rotenone recovery showed no differences in the location of their central tendencies. All 3 sampling methods were selective for bass in the 293 to 368-mm size group. Electrofishing and rotenone also showed selectivity for 445 to 521-mm bass.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

81-000458 Heggberget, T. G. and T. Hesthagen. POPULATION ESTIMATES OF YOUNG ATLANTIC SALMON, *SALMO SALAR* L., AND BROWN TROUT, *SALMO TRUTTA* L., BY ELECTROFISHING IN TWO SMALL STREAMS IN NORTH NORWAY. *Inst. Freshwater Res. Drottingholm Rep.* No. 58. p. 27-33. 1979. SFA 26(1)
[Dir. Wildl. Freshwater Fish, N-7000 Trondheim, Norway]

81-000459 Hourston, A. S. and J. F. Schweigert. COHORT ANALYSIS VS DIRECT MEASURES OF THE ABUNDANCE OF MAJOR POPULATIONS OF HERRING ON CANADA'S WEST COAST, 1971-1979. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 959. iii + 15p. July 1980. In English with French summ. SFA 26(1)
[Dep. Fish. Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Cohort analysis for six major herring populations produced estimates of the abundance of the fully recruited age classes (age 4 and older) most of which were close to direct estimates of the catch and spawning escapement from the current annual stock assessment program for the years 1971 to 1977. Cohort analysis estimates for 1978 and 1979 appear inordinately high in view of evidence of declining abundance from other sources. Estimates by the direct method appear to provide a better basis for management of the fisheries but cohort analysis could play an important role in validating the direct estimates on a continuing basis.

81-000460 Ishida, Y. and S. Tanaka. POPULATION FLUCTUATION OF THE SMALL FILEFISH, *RUDARIUS ERCODES*, IN THE *ZOSTERA* BED IN ODAWA BAY. *Bull. Jpn. Soc. Sci. Fish.* 46(10):1199-1202. Oct. 1980. SFA 26(1)
[Ocean Res. Inst., Univ. Tokyo, Nakano-ku, Tokyo 164, Japan]

81-000461 Johnson, J. H. PRODUCTION AND GROWTH OF SUBYEARLING COHO SALMON, *ONCORHYNCHUS KISUTCH*, CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*, AND STEELHEAD, *SALMO GAIRDNERI*, IN ORWELL BROOK, TRIBUTARY OF SALMON RIVER, NEW YORK. *NOAA Fish Bull.* 78(2):549-554. Apr. 1980. SFA 26(1)
[N.Y. State Dep. Environ. Conserv., 50 Wolf Rd., Albany 12233]

81-000462 Jonsson, B. and T. Østli. DEMOGRAPHIC STRATEGY IN CHAR COMPARED WITH BROWN TROUT IN LAKE LØNE, WESTERN NORWAY. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 45-54. 1979. SFA 26(1)
[Zool. Inst., Univ. Oslo, Blindern, Oslo 3, Norway]

81-000463 Kainua, K. and T. Valtonen. DISTRIBUTION AND ABUNDANCE OF EUROPEAN RIVER LAMPREY (*LAMPETRA FLUVIATILIS*) LARVAE IN THREE RIVERS RUNNING INTO BOTHNIAN BAY, FINLAND. *Can. J. Fish. Aquatic Sci.* 37(11):1960-1966. Nov. 1980. In English with French summ. SFA 26(1)
[Perämeri Res. Stn., Univ. Oulu, Oulu, Finland]

81-000464 Kohlenstein, L. C. ASPECTS OF THE POPULATION DYNAMICS OF STRIPED BASS (*MORONE SAXATILIS*) SPAWNING IN MARYLAND TRIBUTARIES OF THE CHESAPEAKE BAY. *Ph.D. dissertation, Johns Hopkins Univ.* 257p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1226. Oct. 1980. SFA 26(1)

81-000465 Kohlhorst, D. W. RECENT TRENDS IN THE WHITE STURGEON POPULATION IN CALIFORNIA'S SACRAMENTO-SAN JOAQUIN ESTUARY. *Calif. Fish Game* 66(4):210-219. Oct. 1980. SFA 26(1)
[Calif. Dep. Fish Game, Bay-Delta Fish. Proj., 4001 North Wilson Way, Stockton 95205] Recent trends in the white sturgeon, *Acipenser transmontanus*, population in the Sacramento-San Joaquin Estuary were

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

81-000465 CONTINUED evaluated from commercial passenger fishing boat (CPFB) and tagging records. Total catch and catch/angler h on CPFB's declined from 1967 to 1974. Catch/angler h increased from 1974 to 1978, while total catch continued to decrease through 1977. Population estimates suggested that a decrease in abundance occurred between 1967 and 1974 and that abundance increased between 1974 and 1979. Mean size of sturgeon caught on CPFB's increased from 1964 to 1973 or 1974, then decreased through 1978. Annual survival rate changed little over the period examined. The population decline was likely due to poor recruitment from year classes produced after the mid-1950's. Possible causes of low recruitment are discussed.

81-000466 Kushlan, J. POPULATION FLUCTUATIONS OF EVERGLADES FISHES. *Copeia* 1980(4):870-874. 5 Dec. 1980. SFA 26(1)
[South Fla. Res. Cent., Everglades Natl. Park, Homestead 33030]

81-000467 Low, L.-L. and I. Ikeda. AVERAGE DENSITY INDEX FOR WALLEYE POLLOCK, *THERAGRA CHALCOGRAMMA*, IN THE BERING SEA. *NOAA Tech. Rep. NMFS SSRF* 743. iii + 11p. Nov. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

81-000468 Mužík, V. OBSÁDKA PSTRUHA POTOČNÉHO (*SALMO TRUTTA* M. *FARIO* L.) V POTOKU MOŠTENCIA. [*SALMO TRUTTA* M. *FARIO* L.) POPULATION IN THE BROOK MOŠTENICA.] *Biologica (Bratisl.)* 35(8):601-606. Aug. 1980. In Czech with Russian and English summ. SFA 26(1)
[Slovakian Anglers Union, Reg. Comm., Ruttkaya - Nedeckého 2, 974 00 Banská Bystrica, Czechoslovakia] The trout population in the brook Moštenica fluctuated in the spring of 1976 between 629 and 3426 head/hectare and their biomass between 45.08 and 153.28 kg/hectare. In the autumn of that year the trout populaltion fluctuated between 950 and 4595 head/hectare, and their biomass between 75.24 and 267.62 kg/hectare. As to length, there predominated individuals age groups 0-II, i.e. individuals which do not form the takable part of the trout population. In the spring time the catchable length of 23 cm was attained by 8.8% of individuals, in the autumm is increased to 9.55% of 23 and more centimetre-long fish. For practical management from the point of view of fishing the writer recommends to improve on environment also in the other parts of the stream by making cascades and fall-throughs, which would favourably influence the trout population.

81-000469 Mann, R. H. K. THE NUMBERS AND PRODUCTION OF PIKE (*ESOX LUCIUS*) IN TWO DORSET RIVERS. *J. Anim. Ecol.* 49(3):899-915. Oct. 1980. SFA 26(1)
[Freshwater Biol. Assoc., River Lab., East Stoke, Wareham, Dorset, England] The numbers of pike in the River Frome and River Stour were estimated by mark-recapture methods. Population densities in March in the Frome were: O group, from 45 fish/ha (range 38-55) in 1973 to 299/ha (176-382) in 1975; older pike, from 32 fish/ha (27-38) in 1972 to 80/ha (68-95) in 1977. Mean densities of 1 group and older pike in the River Stour in June over 5 yr were 61 fish/ha (27-127). Statistically significant differences between years occurred in the growth of O and 1 group pike in the Frome, but no evidence of density-dependent growth was found. Mean annual production over 5 yr in the Frome was 51.5 kg/ha fresh weight (range 41.9-71.5). One group pike made the greatest contribution (26.8%), whereas maximum biomass occurred in age-group 5(16.8%). The production of O and 1 group fish varied from year to year as a result of fluctuations in growth rate and survival. Mean annual production in the Stour, excluding O group fish, was 26.1 kg/ha (range 9.0-54.9). Population densities and production in the Frome and Stour were high in comparison with results from other waters; the abundance of several species of forage fish, and extensive growths of aquatic plants which could provide cover for the young pike, are suggested as possible reasons. The mean

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

81-000469 CONTINUED $P/\bar{B}$ ratio of 1 group and older pike (Frome 0.60, Stour 0.57) was similar to that of pike in several other habitats, but some differences between years occurred as a result of growth rate changes. Simulation studies on the effects of various levels of fishing mortality showed production to decrease steadily with increased mortality, whereas equilibrium yield increased rapidly and then remained the same or declined slowly. Data from practical management are required to check the accuracy of the predictions from these and other models.

81-000470 Montgomery, J. C.; D. H. Fickeisen and C. D. Becker. FACTORS INFLUENCING SMALLMOUTH BASS PRODUCTION IN THE HANFORD AREA, COLUMBIA RIVER. *Northwest Sci.* 54(4):296-305. Nov. 1980. SFA 26(1)

[Battelle Pac. Northwest Lab., Richland, WA 99352] Forty radio frequency transmitters and 120 dart tags were used to monitor movements of adult smallmouth bass (*Micropterus dolomieui*) in relation to water level fluctuations in the Columbia River at Hanford, Washington, in 1976 and 1977. Adult bass spawned from April through June in warmed sloughs and backwater areas bordering the Columbia River. They returned to the main river channel after spwaning in August, 1976 and in late June, 1977. Bass movement appeared to be influenced by water level fluctuations, water depth, current, and available forage organisms. Radio-tagged bass traveled a maximum of 61 km, and dart tags were returned from as far as 63 km. Spawning success of adult bass was estimated in three study areas: White Bluffs, Hanford, and F Area sloughs. Spawning was adversely influenced by high river levels, which flooded nest sites with cool water and caused other perturbations. Spawning success was relatively poor in 1976, a high-water year, and relatively good in 1977, a low-water year. Loss of juvenile bass due to entrapment, predation, thermal and oxygen stress, and desiccation was monitored during the summer in several temporary ponds created by fluctuating river flows. Adverse ecological factors were related, for the most part, to seasonal water regimes in the Columbia River during the spawning period, and to interseasonal fluctuations in flow levels from hydroelectric power generation at Priest Rapids Dam.

81-000471 Orth, D. J. CHANGES IN THE FISH COMMUNITY OF LAKE CARL BLACKWELL, OKLAHOMA (1967-77) AND A TEST OF THE REPRODUCTIVE GUILD CONCEPT. *Proc. Okla. Acad. Sci.* 60:10-17. 1980. SFA 26(1)

[Okla, Coop. Fish. Res. Unit, Okla, State Univ., Stillwater 74078]

81-000472 Parmanne, R. and V. Sjöblom. ABUNDANCE OF SPRAT EGGS AND LARVAE IN THE NORTHERN BALTIC IN 1979. *Int. Counc. Explor. Sea* C.M. 1980/J:10. 6p. 1980. SFA 26(1)

[Finnish Game Fish. Res. Inst., P.O. Box 193, SF-00131 Helsinki 13, Finland]

81-000473 Parmanne, R. and V. Sjöblom. ABUNDANCE, MORTALITY AND PRODUCTION OF SPRING-SPAWNING BALTIC HERRING LARVAE IN THE SEAS AROUND FINLAND IN 1979. *Int. Counc. Explor. Sea* C.M. 1980/J:9. 16p. 1980. SFA 26(1)

[Finnish Game Fish. Res. Inst., P.O. Box 193, SF-00131 Helsinki 13, Finland] In May-August 1979, weekly samples were taken at seven permanent field stations with the modified Gulf V sampler. The greatest abundance of herring larvae, on average 53 larvae per 10 m^2, was recorded in the Archipelago Sea (ICES subdivision 29, Kustavi). The lowest abundance, 4 per 10 m^2, was recorded in the Bothnian Bay (31, Kalajoki). No decrease can be observed in the larval abundance in 1974-79. In samples taken during a cruise along the Finnish coast, from 8 June to 2 July 1979, the number of

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

81-000473 CONTINUED larvae averaged 18 per 10 m^2. The mean daily instantaneous mortality rate of small larvae in 1979 in subdivisions 29N, 30 and 31 (east) is calculated to be Z = 0.0748 and in subdivision 32 Z = 0.0675. The production of 10-15 mm larvae in 1979 in subdivisions 29N, 30 and 31 (east) is estimated at 5.63×10^{12} and in subdivision 32 at 1.87×10^{12}. According to larval sampling, the year class 1980 is below average off the coast of Finland.

81-000474 Pauly, D. and P. Martosubroto. THE POPULATION DYNAMICS OF *NEMIPTERUS MARGINATUS* (CUVIER & VAL.) OFF WESTERN KALIMANTAN, SOUTH CHINA SEA. *J. Fish Biol.* 17(3):263-273. Sept. 1980. SFA 26(1)

[ICLARM, MCC p.o. Box 1501, Makati, Metro Manila, Philippines] The following parameter values are derived for a West Kalimantan (West Borneo) stock of the threadfin bream, *Nemipterus marginatus*: $L\infty$ = 24.5 cm (L.T.), $W\infty$ = 210 g, K = 0.42, t = -0.41 and M = 1.73. Yield-per-recruit curves for *N. marginatus* are presented. Catch per hour of *N. marginatus* is very low, even in the area of highest density (~3.5 kg/h at 45 m depth). Single-species exploitation of a stock of the type represented by *N. marginatus* appears unfeasible and the conclusion is reached that the traditional single-species approach in fish population dynamics--such as exemplified in this paper--does not help in formulating rational exploitation schemes.

81-000475 Robertson, A. I. THE STRUCTURE AND ORGANIZATION OF AN EELGRASS FISH FAUNA. *Oecologia (Berl.)* 47(1):76-82. Oct. 1980. SFA 26(1)

[Dep. Zool., Univ. Melbourne, Parkville, Victoria 3052, Australia] Ten species of fish made up more than 95 percent of the standing crop of the total fish assemblage of a shallow-water eelgrass meadow in southeastern Australia. The relative abundance of each species remained fairly constant from year to year during a four and a half year period. Four species were permanent residents, three moved over the meadow at high tide, and the juveniles of three species changed residence status as they grew. Most species exhibited distinct diel patterns of activity, four species were diurnal and five were nocturnal. Species foraged in different microhabitats and dietary overlap was very low amongst all but two species which had overlapping habitat, prey and prey size preferences, but had different diel activity periods. Data on production by prey and consumption of prey by these two fish species indicated that competition for food was probably responsible for the temporal separation of feeding niches. Predation by birds and fish appeared to be the major influence on the diel activity period of one fish species. The maintenance of the patterns of resource allocation among the remaining species is discussed and the organization of different seagrass fish faunas is compared.

81-000476 Schweigert, J. F. and A. S. Hourston. COHORT ANALYSIS AND MORTALITY RATES OF THE BARKLEY SOUND HERRING STOCK, 1972-1979. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 960. iv + 37p. July 1980. In English with French summ. SFA 26(1)

[Dep. Fish, Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] The numbers of fish at age and fishing mortality rates are estimated by cohort analysis for the Barkley Sound herring stock between 1972 and 1979. The analysis is run for a series of instantaneous natural mortality rates (M) ranging between .20 and .64 corresponding to values employed in the literature and a series of instantaneous fishing mortality rates (f) ranging from .3-.7. Taking 1974 as an example of a year early in the series which also has good data for the current direct estimates of abundance from catch and spawning escapement, the various values assigned to F had little effect on the estimates of numbers of fish whereas the values assigned to M resulted in a threefold difference in the range of the abundance estimates. Values

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81-000476 CONTINUED derived from Barkley Sound data (average F = .59, M = .36_ were considered most representative although they produced estimates of abundance which were twice as large as the direct estimates from catch and escapement. The implications of these differences are discussed.

81-000477 Shimazaki, K.; T. Ishida and K. Takagi. [AN ANALYSIS OF THE NON-SELECTIVE SALMON GILLNET FISHING DATA OF PINK SALMON CAUGHT BY THE RESEARCH VESSELS, HOKUSEI-MARU AND OYASHIO-MARU, OPERATED IN THE WATERS OFF THE KURIL ISLANDS AND WEST KAMCHATKA, FROM 1972 TO 1976.] *Bull. Fac. Fish. Hokkaido Univ.* 31(3):229-238. Aug. 1980. In Japanese with English summ. SFA 26(1)
[Res. Inst. North Pac. Fish., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

81-000478 Sjöblom, V.; E. Aro and P. Suuronen. MIGRATIONS, MORTALITY AND GROWTH OF COD IN THE NORTHERN BALTIC SEA. *Int. Counc. Explor. Sea* C.M. 1980/J:8. 15p. 1980. SFA 26(1)
[Univ. Helsinki, Dep. Linmol., Viikki, SF-00710 Helsinki 71, Finland] In all 6,425 cod were tagged in Finland in 1974-78. Of the total recoveries made after the first three months following tagging, 66.5% were reported outside the Finnish fishing zone. Although the reported recaptures were distributed in all parts of the Baltic Sea proper, the recoveries were not proportional to the catches of the various nations. Migration of cod from the Finnish fishing zone occured primarily in connection with spawning. The mean total instantaneous mortality rate (Z) for 1975-77 in the length groups of 30 cm and over was estimated at 1.09. Calculated from the tagging data, $L\infty$ was 103 cm and K 0.192.

81-000479 Stauffer, G. D. and K. Parker. ESTIMATE OF THE SPAWNING BIOMASS OF THE NORTHERN ANCHOVY CENTRAL SUBPOPULATION FOR THE 1978-79 FISHING SEASON. *Calif. Coop. Oceanic Fish. Invest.* 21:12-16. July 1980. SFA 26(1)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

81-000480 Stauffer, G. D. ESTIMATE OF THE SPAWNING BIOMASS OF THE NORTHERN ANCHOVY CENTRAL SUBPOPULATION FOR THE 1979-80 FISHING SEASON. *Calif. Coop. Oceanic Fish. Invest.* 21:17-25. July 1980. SFA 26(1)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

81-000481 Sunada, J. S. and S. Silva. THE FISHERY FOR NORTHERN ANCHOVY, *ENGRAULIS MORDAX*, OFF CALIFORNIA AND BAJA CALIFORNIA IN 1976 AND 1977. *Calif. Coop. Oceanic Fish. Invest.* 21:132-138. July 1980. SFA 26(1)
[Calif. Dep. Fish Game, 350 Golden Shore, Long Beach 90802] Anchovy landings for 1976 totaled 189,066 metric tons (208,407 tons) with 60% landed by American fishermen and 40% by Mexico. The 1977 landings amounted to 243,124 metric tons (267,995 tons) with 58% landed by Mexican boats and the remaining 42% by U.S. fishermen. Age composition of the 1976 catch consisted largely of the 1973 year class for southern California samples, whereas the 1976 year class dominated Baja California samples. The 1976 year class dominated samples from both southern and Baja California during 1977. Average fish sizes in 1976 were 106 mm standard length (Baja California) and 125 mm SL (California), whereas in 1977 the mean length of the Mexican fish increased to 113 mm SL although California-caught fish decreased in size to 120 mm SL. Sex ratios ranged during 1976 from 2.15 females to 1 male (Baja California) to 1.16 females per 1 male (southern California), whereas in 1977 the sex ratios were much closer to 1:1 in California and in Baja California.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

81-000482 Baugh, T. M. SPAWNING OF THE LEAST CHUB (*IOTICHTHYS PHLEGETHONTIS*). *Great Basin Nat.* 40(2):139-140. 30 June 1980. SFA 26(1)
[1020 Custer Ave., Ogden, UT 84404]

81-000483 Bietz, B. F. ADAPTIVE SIGNIFICANCE OF TERRITORIAL AGGREGATION BY MALE LONGEAR SUNFISH. *Am. Zool.* 20(4):826. 1980. Abstract only. SFA 26(1)
[Univ. West. Ont., London, ON, Canada]

81-000484 Brillet, C. COMPORTEMENT SEXUELL DU POISSON AMPHIBIE *PERIOPHTHALMUS SOBRINUS* EGGERT SES RAPPORTS AVEC LE COMPORTMENT AGONISTIQUE. [THE COURTSHIP OF THE MUDSKIPPER *PERIOPHTHALMUS SOBRINUS* AND ITS RELATIONSHIP WITH AGONISTIC BEHAVIOUR.] *Rev. Ecol.* 34(3):427-468. July-Sept. 1980. In French with English summ. SFA 26(1)
[Dep. Psychophysiol. Comp. Inst. Neurophysiol. Psychophysiol., C.N.R.S., 31, Chemin Joseph-Aiguier, F13274 Marseille-Cedex 2, France]

81-000485 Combs, D. L. STRIPED BASS SPAWNING IN THE ARKANSAS RIVER TRIBUTARY OF KEYSTONE RESERVOIR, OKLAHOMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:371-383. 1979(1980). SFA 26(1)
[Okla. Dep. Wildl. Conserv., 4101 Boston, Muskogee 74401] Spawning locations of striped bass (*Morone saxatilis*) were identified over a 118 km reach of the Arkansas River from the collection of 8,828 striped bass eggs during 1976-78. Although certain spawning locations remain constant from year to year others vary significantly within the 118 km stretch of river. Spawning began between 7 and 14 April when water temperature reached 15.5 to 18.5C and had a duration of 27 to 51 days. Spawning peaks occurred annually, generally within a few days from one year to the next. Water temperature, discharge, velocity, total dissolved solids, specific conductance, salinity, pH, alkalinity and dissolved oxygen were monitored, however, no relationship to egg production was found. However, salinity affected egg chorion diameters during the study. Chorion diameters of striped bass eggs in the Arkansas River (1.7 to 2.0 mm) were much smaller than previously reported for striped bass, due to high salinities arresting chorion expansion.

81-000486 Davis, S. M. AMERICAN SHAD MOVEMENT, WEIGHT LOSS AND LENGTH FREQUENCIES BEFORE AND AFTER SPAWNING IN THE ST. JOHNS RIVER, FLORIDA. *Copeia* 1980(4):889-892. 5 Dec. 1980. SFA 26(1)
[South Fla. Water Manage. Dist., P.O. Box V, West Palm Beach 33402]

81-000487 Emadi, H. THE STATE OF THE FISHING AND REPRODUCTION OF THE KUTUM, *RUTILUS FRISII KUTUM*, IN THE CASPIAN SEA OF IRAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):151-154. 1979. SFA 26(1)

81-000488 Farr, J. A. SOCIAL BEHAVIOR PATTERNS AS DETERMINANTS OF REPRODUCTIVE SUCCESS IN THE GUPPY, *POECILIA RETICULATA* PETERS (PISCES: POECILIIDAE). AN EXPERIMENTAL STUDY OF THE EFFECTS OF INTERMALE COMPETITION, FEMALE CHOICE, AND SEXUAL SELECTION. *Behaviour* 74(1-2):38-91. 1980. In English with German summ. SFA 26(1)
[Inst. Biol., Gesellschaft für Strahlen-und Umweltforsh., Neuherberg, West Germany]

81-000489 Farr, J. A. THE EFFECTS OF SEXUAL EXPERIENCE AND FEMALE RECEPTIVITY OF COURTSHIP-RAPE DECISIONS IN MALE GUPPIES, *POECILIA RETICULATA* (PISCES: POECILIIDAE). *Anim. Behav. (Baillière*

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81-000489 CONTINUED *Tindall, Publ.*) 28(4):1195-1201. Nov. 1980. SFA 26(1)
[Inst. Biol., Gesellschaft Strahlenforsch. Umweltforsch., D-8042 Neuherberg München, West Germany] This paper examines the effects of prior sexual experience and of female receptivity on the probability that male guppies will court females with high or low intensity displays or attempt rape. There were no differences in behaviour between males with a history of high copulation success and those with low copulation success. Males with receptive females exhibited higher levels of high intensity displays and fewer rape attempts than males with unreceptive females, regardless of prior experience. The results are discussed in terms of sexual selection and the selective advantage of behavioural plasticity in which different sexual behaviour patterns are chosen with respect to the probability of a successful mating at a given time.

81-000490 Ferraro, S. P. DAILY TIME OF SPAWNING OF 12 FISHES IN THE PECONIC BAYS, NEW YORK. *NOAA Fish. Bull.* 78(2):455-464. Apr. 1980. SFA 26(1)
[Dep. Ecol. Evol., State Univ. N.Y., Stony Brook 11794]

81-000491 Fricke, H. W. MATING SYSTEMS, MATERNAL AND BIPARENTAL CARE IN TRIGGERFISH (BALISTIDAE). *J. Comp. Ethol.* 53(2):105-122. 1980. In English with German summ. SFA 26(1)
[Max-Planck-Inst. Verhattensphysiol., D-8131 Seewiesen, West Germany]

81-000492 Goldberg, S. R. SEASONAL SPAWNING CYCLE OF THE LONGSPINE COMBFISH, *ZANIOLEPIS LATIPINNIS*, WITH NOTES ON SPAWNING OF THE SHORTSPINE COMBFISH, *ZANIOLEPIS FRENATA* (ZANIOLEPIDIDAE). *Copeia* 1980(4):882-884. 5 Dec. 1980. SFA 26(1)
[Dep. Biol., Whittier Coll., Whittier, CA 90608]

81-000493 Gross, M. R. and E. L. Charnov. ALTERNATIVE MALE LIFE HISTORIES IN BLUEGILL SUNFISH. *Proc. Natl. Acad. Sci. U.S.A.* 77(11):6935-6940. Nov. 1980. SFA 26(1)
[Dep. Zool., Univ. Wash., Seattle 98195] Male bluegill sunfish are shown to have two alternative mating strategies: cuckoldry or parental care. Cuckolder males first mature at age 2. They follow a developmental sequence of sneaking and then mimicking female behavior to deceptively gain access to spawnings. Males who become parentals (construct nests, attract females, provide brood care) delay maturation until age 7. The parental investment of these males is parasitized by the cuckolders. This system is an example of a truly parasitically dependent mating strategy in vertebrates. A natural selection model is developed to predict the equilibrium frequencies of the two male types. A preliminary test of the model provides qualitative agreement.

81-000494 Gross, M. R. CUCKOLDRY AND PARENTAL CARE IN SUNFISHES - IS THERE AN EQUILIBRIUM.? *Am. Zool.* 20(4):826. 1980. Abstract only. SFA 26(1)
[Zool. Dep., Univ. Wash., Seattle]

81-000495 Gunderson, D. R.; P. Callahan and B. Goiney. MATURATION AND FECUNDITY OF FOUR SPECIES OF *SEBASTES Mar. Fish. Rev.* 42(3-4):74-79. Mar.-Apr. 1980. SFA 26(1)
[Fish. Res. Inst., Univ. Wash., Seattle 98195] Length-maturity relationships were determined for yellowtail rockfish, *Sebastes flavidus*; canary rockfish, *S. pinniger*, chilipepper, *S. goodei*, and bocaccio, *S. paucispinis*. Length-fecundity relationships were determined for all but the latter. Geographic differences in fecundity were examined for canary rockfish and chilipepper; significant differences were found in samples from

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81-000495 CONTINUED chilipepper populations that were 93-185 km (50-100 nautical miles) apart. The results obtained in this study were conpared with the limited information published previously. The management implications of differences in fecundity are discussed.

81-000496 Gunn, J. M. and W. Keller. ENHANCEMENT OF THE SURVIVAL OF RAINBOW TROUT (*SALMO GAIRDNERI*) EGGS AND FRY IN AN ACID LAKE THROUGH INCUBATION IN LIMESTONE. *Can. J. Fish. Aquatic Sci.* 37(10):1522-1530. Oct. 1980. In English with French summ. SFA 26(1)
[Ontario Minist. Nat. Resour., Sudbury, ON P3A 4S2, Canada]

81-000497 Hein, S. and J. Shepard. SPAWNING OF SPOTTED SEATROUT IN A LOUISIANA ESTUARINE ECOSYSTEM. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:451-465. 1979(1980). SFA 26(1)
[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle 70358] Biomodal spawning peaks, as determined by the gonadosomatic index, were noted for the spotted seatrout (*Cynoscion nebulosus*) in the Barataria Bay, Louisiana, system for 1976 and 1978. Males matured earlier in the season and at a smaller size than females. Males were found to have sound producing capabilities. Fish spawned throughout the bay regardless of water depth or substrate. Spawning seemed to occur in the northern portion of the bay later than in the southern portion. Photoperiod and temperature were the only exogenous factors found to have a direct relationship with spawning.

81-000498 Heins, D. C.; G. E. Gunning and J. D. Williams. REPRODUCTION AND POPULATION STRUCTURE OF AN UNDESCRIBED SPECIES OF *NOTROPIS* (PISCES: CYPRINIDAE) FROM THE MOBILE BAY DRAINAGE, ALABAMA. *Copeia* 1980(4):822-830. 5 Dec. 1980. SFA 26(1)
[Dep. Biol., Millsops Coll., Jackson, MS 39210] Although undescribed, *Notropis* sp. (cf. *N. longirostris*) has been recognized as a distinct species for some time. It occurs in small to moderate size streams throughout the Mobile Bay drainage below the Fall Line, but is rare above it. Habitat and species associates are considered briefly. In Uphapee Creek, Macon County, Alabama, the reproductive season extended in 1974 from early to mid April into late September or early October. Counts of mature ova were correlated with female size and ranged from 99 to 323 for females 31-41 mm SL. Unovulated mature ova were 0.70-0.90 mm in diameter. Males matured sexually at a slightly smaller size than females; all males were mature by 29 mm SL and all females by 31 mm SL. The sex ratio did not differ from 1:1. This species of *Notropis* lives about 1½ to 2 years. Maturity occurs at about one year. Maximum size was ca. 45 mm SL.

81-000499 Hoffman, S. G. and M. C. Stouder. THE BIG MALES ARE CHEAP: ALLOCATION OF TIME AND ENERGY IN THE REDBAND PARROTFISH. *Am. Zool.* 20(4):826. 1980. Abstract only. SFA 26(1)
[Smithsonian Trop. Res. Inst., Panama]

81-000500 Honda, H. FEMALE SEX PHEROMONE OF RAINBOW TROUT, *SALMO GAIRDNERI*, INVOLVED IN COURTSHIP BEHAVIOR. *Bull. Jpn. Soc. Sci. Fish.* 46(9):1109-1112. Sept. 1980. SFA 26(1)
[Cent. Res. Inst. Elec. Power Ind., Abiko, Chiba 270-22, Japan]

81-000501 Honda, H. FEMALE SEX PHEROMONE OF THE LOACH, *MISGURNUS ANGUILLICAUDATUS*, INVOLVED IN COURTSHIP BEHAVIOUR. *Bull. Jpn. Soc. Sci. Fish.* 46(10):1223-1225. Oct. 1980. SFA 26(1)

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81-000501 CONTINUED
[Cent. Res. Inst. Elec. Power Indus., Abiko, Chiba 270-11, Japan] It was demonstrated that male loach, *Misgurnus anguillicaudatus*, were able to discriminate post-ovulatory females from pre-ovulatory ones on the basis of a chemical cue. Some important aspects derived from the experiments are listed as follows; 1. Post-ovulatory females released a sex pheromone, which males detected by olfaction. 2. The female sex pheromone was present in the ovaries and the genital cavity fluid of post-ovulatory females. 3. The effect of the female sex pheromone on males lasted less than 3 h after ovulation. 4. The female sex pheromone played roles such as informing males of the occurrence of ovulation, attracting males, and eliciting persistent courtship of males.

81-000502 Hunter, J. R. and B. J. Macewicz. SEXUAL MATURITY, BATCH FECUNDITY, SPAWNING FREQUENCY, AND TEMPORAL PATTERN OF SPAWNING FOR THE NORTHERN ANCHOVY, *ENGRAULIS MORDAX*, DURING THE 1976 SPAWNING SEASON. *Calif. Coop. Oceanic Fish. Invest.* 21:139-149. July 1980. SFA 26(1)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038] Fifty percent of anchovy females reach sexual maturity by 96 mm standard length (95% confidence level 94-97 mm). Spawning batch fecundity, estimated from counts of hydrated eggs, was an exponential function of female weight. (LnY=4.2886 + 1.6281 LnX, where Y= number of hydrated eggs and X= female weight less ovary weight in grams). In the Los Angeles Bight the proportion of the population spawning/day (incidence of day-old post-ovulatory follicles) declined from 13.4% of the females in January-February to 10.0% in March-April and fell to 3.4% by June. Incidence of atresia in ovaries increased as the frequency of spawning declined. The percentage of females classed as post-spawning on the basis of the atretic condition of the ovary was 0.3% in January-February and 12% in March-April. Spawning of anchovy in Monterey Bay had nearly ended in March, and 71.9% of the females were classed as post-spawning. The incidence of females with new post-ovulatory follicles and with hydrated eggs indicated that by sunset eggs were completely hydrated and spawning began; spawning reached a maximum between 2200-2300 hours and ended by 0200 hours. At 0600 hours females destined to spawn the next night began to hydrate eggs.

81-000503 Jenkins, R. E. and D. J. Jenkins. REPRODUCTIVE BEHAVIOR OF THE GREATER REDHORSE, *MOXOSTOMA VALENCIENNESI*, IN THE THOUSAND ISLANDS REGION. *Can. Field-Nat.* 94(4):426-430. Oct.-Dec. 1980. SFA 26(1)
[Dep. Biol., Roanoke Coll., Salem, VA 24153] Reproductive behavior of the Greater Redhorse, *Moxostoma valenciennesi* (Teleostei, Catostomidae), was observed in the Thousand Islands region, upper St. Lawrence River during three spawning seasons. Spawning occurred in a 2-wk period from late June to early July, with water temperatures 16-19°C. Males congregated in shallow runs of sand, gravel, and small rubble substrate, where they generally moved about slowly and frequently nudged and gently pushed on another. Females entered spawning areas generally only when apparently ready to spawn and did not initiate agonistic behavior. Females selected spawning sites, usually gravel. Typical spawning acts involved one female flanked on each side by a male; other males often attempted to join the trio. No nest construction or parental care occurred. American Eels (*Anguilla rostrata*), Fallfish (*Semotilus corporalis*), and Yellow Perch (*Perca flavescens*) preyed on redhorse eggs.

81-000504 Jones, G. P. GROWTH AND REPRODUCTION IN THE PROTOGYNOUS HERMAPHRODITE *PSEUDOLABRUS CELIDOTUS* (PISCES: LABRIDAE) IN NEW ZEALAND. *Copeia* 1980(4):660-675. 5 Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Auckland, Private Bag, Auckland, New Zealand]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

81-000505 Klauda, R. J. COURTSHIP BEHAVIOR OF ATLANTIC TOMCOD (*MICROGADUS TOMCOD*). *Presented at the Northeastern Regional Meeting of the Animal Behavior Society, Monmouth College, New Jersey, 21-23 Oct. 1978.* SFA 26(1)
[Texas Instruments Inc., P.O. Box 237, Buchanan, NY 10511] The Atlantic tomcod is a small member of the cod family (Gadidae) that commonly ranges from Newfoundland to Virginia. Often referred to as the "frost fish", tomcod generally spawn under ice cover in estuarine shoals and freshwater tributaries from November to February. While culturing Hudson River tomcod eggs in January and February 1978, I observed courtship behavior in mixed groups of 1-2 females and 3-4 males held in 30 gallon aquaria. Several ripe fish were present but observed courtship always involved a single male (usually the largest) and female. Males would initiate courtship by approaching a ripe female and nudging her flank. If she remained passive, he would roll over and try to position himself under her, facing in the same direction, with their ventral surfaces aligned and touching. He would often use his pelvic fins to gain alignment. Actual discharge of eggs and sperm was not observed but tomcod spawned successfully in the aquaria. Fertilization success should be high in Atlantic tomcod since their courtship behavior suggests they are not broadcast spawners.

81-000506 Klimley, A. P. OBSERVATIONS OF COURTSHIP AND COPULATION IN THE NURSE SHARK, *GINGLYMOSTOMA CIRRATUM*. *Copeia* 1980(4):878-882. 5 Dec. 1980. SFA 26(1)
[Grad. Dep., A-008, Scripps Inst. Oceanogr., La Jolla, CA 92093]

81-000507 Kloth, T. C. OBSERVATIONS ON THE SPAWNING BEHAVIOR OF CAPTIVE FLORIDA POMPANO, *TRACHINOTUS CAROLINUS*. *Copeia* 1980(4):884-886. 5 Dec. 1980. SFA 26(1)
[2596 Hedgerow Dr., Marietta, GA 30066]

81-000508 Kratt, L. F. and R. J. F. Smith. AN ANALYSIS OF THE SPAWNING BEHAVIOUR OF THE ARCTIC GRAYLING *THYMALLUS ARCTICUS* (PALLAS) WITH OBSERVATIONS ON MATING SUCCESS. *J. Fish Biol.* 17(6):661-666. Dec. 1980. SFA 26(1)
[Environmental Management Assoc., 1530 Tenth Ave. S.W., Calgary, AB T3C 0J5, Canada] In the Fond du Lac River, adult male Arctic grayling defend territories on the spawning ground for up to 7 days. Females do not defend territories and do not exhibit agonistic behaviour during the breeding season. The behaviour patterns exhibited by Arctic grayling during spawning are virtually identical to those exhibited by European grayling. The characteristic large dorsal fin of the grayling is of major importance during the spawning act. Less than 50% of all spawning attempts proceed to completion. Interference by other fish or the improper orientation of one fish may result in one member of the spawning pair moving away. Most often however, incomplete acts are the result of the female moving away for no apparent reason. Females may initally 'test' males or may simply not be ready to spawn when approached by males. Homosexual spawning attempts were rarely observed.

81-000509 Lambert, T. R.; C. L. Toole; J. M. Handley; D. F. Mitchell; J. C. S. Wang and M. A. Koeneke. ENVIRONMENTAL CONDITIONS ASSOCIATED WITH SPAWNING OF A LANDLOCKED AMERICAN SHAD (*ALOSA SAPIDISSIMA*) POPULATION. *Am. Zool.* 20(4):813. 1980. Abstract only. SFA 26(1)
[Pac. Gas Elec. Co., San Ramon, CA] The only known reproducing population of landlocked American shad exists in Millerton Lake, a reservoir on California's San Joaquin River. Studies in 1979 and 1980 showed gonadal maturation in adults began in March when the fish are in the lower portion of the reservoir. In April and May the adults moved to the upper arm of the

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81-000509 CONTINUED reservoir into turbulence created by the inflowing river. Spawning began in this turbulent area in May and continued until August. Nearly all spawning occurred at night. The river inflow ranged from 50 to 200 m^3/sec during spawning. The fish spawned in an average surface velocity of .5m/sec. Temperature gradually increased from 11.5 to 18°C and specific conductivity ranged from 15 to 25 µmho/cm during the spawning period.

81-000510 Lee, R. M. and S. D. Gerking. SURVIVAL AND REPRODUCTIVE PERFORMANCE OF THE DESERT PUPFISH, *CYPRINODON N. NEVADENSIS* (EIGENMANN AND EIGENMANN), IN ACID WATERS. *J. Fish Biol.* 17(5):507-515. Nov. 1980. SFA 26(1)

[Ariz. State Univ., Tempe 85281] Desert pupfish, *Cyprinodon n. nevadensis*, were exposed to pH levels of 8.3 (control), 7.0, 6.5, 6.0, 5.5 and 5.0 to determine the effects of acidity on reproduction. Egg production was significantly reduced at every pH level tested below the control. Egg-laying virtually ceased at pH 5.0, while egg viability was reduced to less than 50% of the control value at pH 6.5, when eggs were tested at the same pH at which they were laid. The 96 h LC_{50} for this species was pH 4.56, considerably below that for successful reproduction. Larvae were less tolerant to acid stress than were adults. Acclimation of reproductive performance to increased acid levels did not occur. Reproductive performance did not fully recover to control levels when the fish were placed in more favourable conditions after prolongd exposure to low pH. Reduction in the number and development of oocytes was observed in the ovaries of acid stressed fish resulting in the decreased reproductive potential.

81-000511 Manion, P. J. and L. H. Hanson. SPAWNING BEHAVIOR AND FECUNDITY OF LAMPREYS FROM THE UPPER THREE GREAT LAKES. *Can. J. Fish. Aquatic Sci.* 37(11):1635-1640. Nov. 1980. In English with French summ. SFA 26(1)

[U.S. FWS, Twin Cities, MN 55111]

81-000512 Moore, C. J. SPAWNING OF *MENIDIA MENIDIA* (PISCES: ATHERINIDAE). *Copeia* 1980(4):886-887. 5 Dec. 1980. SFA 26(1)

[S. C. Wildl. Mar. Resour. Dep., Charleston 29412]

81-000513 Newcombe, C. P. and G. F. Hartmen. VISUAL SIGNALS IN THE SPAWNING BEHAVIOUR OF RAINBOW TROUT. *Can. J. Zool.* 58(10):1751-1757. Oct. 1980. In English with French summ. SFA 26(1)

[Fish Wildl. Br., Minist. Environ., Victoria, BC, Canada] Aspects of the behaviour of sexually mature rainbow trout, when mimicked by fishlike wooden models on spawning beds, induced displays of reproductive behaviour in males of the species. The total amount of male reproductive behaviour, and the amounts of posturing, gaping, and spawning elicited in tests were significantly correlated with the rank of tests arranged in descending order of priority, from those that most accurately depict the reproductive behaviour of a female rainbow trout to those that least accurately depict it (Spearman's rank correlation coeficient for total amount of male behaviour is $p = -0.867$, $P<0.01$, $N = 12$. For posturing, gaping, and spawning, $p = -0.7143$, -0.9524, and -0.8690, respectively, $P<0.05$, 0.01 and 0.01, $N = 8$). Sex recognition is governed largely by the distance of the model above the gravel. Males courted static models stationed 0 and 5 cm above the gravel, attacked a fusiform model stationed 10 cm above a flat gravel bottom, and attacked and courted the same model stationed 10 cm above a nest. Signals that induced posturing included the model's proximity to the gravel, and the action of a puppet, which was capable of movement, settling down into the nest, or onto the gravel. The puppet's action of rising up off the gravel terminated posturing.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

81-000514 Nikol'skaya, T. L. CHANGES IN THE STAGES OF GONAD MATURITY OF THE DEEPWATER REDFISH, *SEBASTES MENTELLA*, IN THE REGION OF SOUTHERN LABRADOR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):154-156. 1979. SFA 26(1)
[PINRO, Murmansk, USSR]

81-000515 Stein, D. L. ASPECTS OF REPRODUCTION OF LIPARID FISHES FROM THE CONTINENTAL SLOPE AND ABYSSAL PLAIN OFF OREGON, WITH NOTES ON GROWTH. *Copeia* 1980(4):687-699. 5 Dec. 1980. SFA 26(1)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331] Reproduction of 13 species of bathyal and abyssal benthic liparids (*Osteodiscus cascadiae, Acantholiparis opercularis, Paraliparis latifrons, P. rosaceus, P. megalopus, P. mento, P. cephalus, Careproctus melanurus, C. microstomus, C. oregonensis, C. ovigerum, C. longifilis* and *C. filamentosus*) off the coast of Oregon was studied. Information on fecundity, reproductive periodicity, size at maturity and length-weight relationships were obtained from all but *P. cephalus* and *C. filamentosus*. These species can be divided into three groups on the basis of fecundity relationships, and into two groups based on whether they appear to spawn throughout the year or periodically. Characterization of species as continuous or periodic spawners was based upon presence of ripe eggs throughout the year, presence of ripe eggs seasonally, or size distributions of ovarian eggs in the ripe females. Species which spawn throughout the year are all primarily abyssal (>2,100 m). Those spawning at relatively long intervals (the durations and frequencies of which are generally unknown) are bathyal and abyssal. All ripe females had large (2.5-8.0 mm diameter) eggs. Maximum fecundities of the species ranged from six to 1,277. Based upon previously published information and the new data, a possible life history for abyssal liparids is constructed.

81-000516 Tomita, M.; M. Iwahashi and R. Suzuki. [NUMBER OF SPAWNED EGGS AND OVARIAN EGGS AND EGG DIAMETER AND PER CENT EYED EGGS WITH REFERENCE TO THE SIZE OF THE FEMALE CARP.] *Bull. Jpn. Soc. Sci. Fish.* 46(9):1077-1081. Sept. 1980. In Japanese with English summ. SFA 26(1)
[Niigata Pref. Freshwater Fish. Exp. Stn., Ookawaramachi, Nagaoka, Niigata 940-11, Japan]

81-000517 Toole, C. L.; T. R. Lambert; D. F. Mitchell and M. S. Koeneke. REPRODUCTIVE CHARACTERISTICS OF LANDLOCKED AMERICAN SHAD (*ALOSA SAPIDISSIMA*) FROM MILLERTON LAKE, CA. *Am. Zool.* 20(4):812. 1980. Abstract only. SFA 26(1)
[Ecological Analysts, Inc., Concord, CA] Landlocked American shad from Millerton Lake were collected between 1978-1980. Scale reading and fecundity estimates indicate that this population exhibits unique reproductive characteristics. The percentage of repeat spawners, mean number of previous spawnings, and total lifetime fecundity are higher than for anadramous populations. Growth rate and age at maturity are lower. Relative fecundity is similar to that of mid-Atlantic populations. The high degree of iteroparity may result from the short spawning run, the absence of a salinity gradient, and the moderate amount of somatic reserves transferred to gamete production. It may insure survival of the population since yearly variations of temperature and inflow produce strong fluctuations in year class strength. Early maturity and high lifetime fecundity also may be adaptive in this fluctuating environment.

81-000518 Volodin, V. M. THE FECUNDITY OF THE PERCH, *PERCA FLUVIATILIS*, FROM RYBINSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):85-92. 1979. SFA 26(1)
[Inst. Biol. Inland Waters, Borok, Yaroslavsk Reg., USSR] The absolute fecundity of the perch, *Perca fluviatilis*, from Rybinsk Reservoir varies from 9575 to 96,867 eggs, the relative fecundity from 91 to 473 eggs per g of

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

81-000518 CONTINUED body weight without viscera. The functional activity of the gonads does not remain stable throughout the life of the females. A period of heightened activity is followed by a certain stabilization, and then a decrease. The fecundity of females of the same size differs in different parts of the reservoir, which is evidently due mainly to the different rate of recreational fishing. In the present stage of formation of the reservoir, perch females from Rybinsk Reservoir of the same size have a higher fecundity than perch in the Volga River prior to regulation of its discharge.

81-000519 Weis, J. S. and M. Heber. COMPARATIVE REPRODUCTIVE BIOLOGY OF TWO POPULATIONS OF *FUNDULUS HETEROCLITUS*. *Am. Zool.* 20(4):880. 1980. Abstract only. SFA 26(1)

[Rutgers Univ., Newark, NJ] *Fundulus heteroclitus* is found along the Atlantic Coast from the Gulf of St. Lawrence to Texas, in shallow water water ranging in saliity from 0°/oo to 32°/oo. Fish used in this research were collected from non-polluted waters of Lake Montauk, N.Y. and highly polluted waters of Piles Creek, N.J. Eggs stripped from Montauk fish could be fertilized in a wide range (10-30°/oo) of salinities. Piles Creek eggs fertilized most successfully in 15°/oo, but not in 30°/oo. The production of viable eggs was highly variable in Montauk fish (20-100%), while Piles Creek fish produced consistently high (80-100%) viable eggs. The Montauk egg ranged in adhesiveness from non-sticky to very sticky, while Piles Creek eggs were all non-sticky. Both populations differ in the range of oil droplets within their eggs. Piles Creek eggs ranged from 30-100 droplets, while Montauk eggs ranged from 20-70 droplets. Spawning cycles also differed. Egg availability of Piles Creek fish closely followed high tides of the new and full moon, while the Montauk population showed very little cyclic effect. At 24°C, Piles Creek eggs developed faster than the Montauk eggs.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

81-000520 Bertmar, G. HOME RANGE, MIGRATIONS AND ORIENTATION MECHANISMS OF THE RIVER INDALSÄLVEN TROUT, *SALMO TRUTTA* L. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 5-26. 1979. SFA 26(1)

[Dep. Ecol. Zool., Univ. Umeå, Sweden S-90187]

81-000521 Brandt, S. B. SPATIAL SEGREGATION OF ADULT AND YOUNG-OF-THE-YEAR ALEWIVES ACROSS A THERMOCLINE IN LAKE MICHIGAN. *Trans. Am. Fish. Soc.* 109(5):469-478. Sept. 1980. SFA 26(1)

[Div. Fish. Oceanogr., Commonwealth Sci. Ind. Res. Organ., P.O. Box 21, Cronulla, N.S.W. 2230, Australia]

81-000522 Cada, G. F.; J. M. Loar and K. D. Kumar. DIEL PATTERNS OF ICHTHYOPLANKTON LENGTH-DENSITY RELATIONSHIPS IN UPPER WATTS BAR RESERVOIR, TENNESSEE. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 79-90. Sept. 1980. SFA 26(1)

[Environ. Sci., Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830] A diel ichthyoplankton sampling program was conducted in upper Watts Bar Reservoir during 1978 to obtain information on (1) diel changes in abundance of fish larvae in the planktonic drift and (2) the extent of visually mediated sampling gear avoidance by motile larvae. Two-way analysis of variance tests revealed few significant diel differences in densities of individual taxa (all sizes conbined) but showed consistently significant diel differences in mean total lengths of fish larvae. Size-specific, day-night density ratios

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

81-000522 CONTINUED were used to elucidate diel patterns in clupeid larvae densities. Clupeids in the 5 to 18 mm total length range were more abundant in surface samples during the day than during the night. Clupeid larvae either smaller or larger were relatively more abundant during the night. It is likely that the greater nocturnal densities of larger larvae were due to the inhibition of visual gear avoidance during the night. Although no direct evidence is available, we believe that diel vertical migration also influenced the observed patterns in size-specific, day-night density ratios.

81-000523 Cargill, A. S. II. LACK OF RAINBOW TROUT MOVEMENT IN A SMALL STREAM. *Trans. Am. Fish. Soc.* 109(5):484-490. Sept. 1980. SFA 26(1)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

81-000524 Clark, A. L. and W. D. Pearson. DIURNAL VARIATIONS IN ICHTHYOPLANKTON DENSITIES AT OHIO RIVER MILE 571. *Trans. Ky. Acad. Sci.* 41(3-4):116-121. Sept. 1980. SFA 26(1)
[Woodward-Clyde Consultants, 3489 Kurtz St., San Diego, CA 92110] Replicate surface and bottom tows were taken every other hour on 30 and 31 May 1977 at Ohio River Mile 571 to determine diurnal variations in densities of fish eggs and larvae. Fish eggs and 14 taxa of fish larvae were collected. Most fish eggs were found in daylight (afternoon) samples while significantly more fish larvae were present in the night samples.

81-000525 Gallagher, R. P. and J. V. Conner. SPATIO-TEMPORAL DISTRIBUTION OF ICHTHYOPLANKTON IN THE LOWER MISSISSIPPI RIVER, LOUISIANA. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 101-115. Sept. 1980. SFA 26(1)
[Sch. For. Wildl. Manage., La. State Univ., Baton Rouge 70803] Planktonic young of fishes were sampled monthly or semi-monthly with a 1-m conical tow net in the lower Mississippi River near St. Francisville, Louisiana, during 1976 and 1977. Representatives of Clupeidae, Cyprinidae, Catostomidae, and Sciaenidae contributed roughly 98 percent of all fishes. Fishes tended to be most abundant at shoreline stations with greatest turbulence. Younger fishes appeared in greater densities during daylight at fastwater stations, while older larvae and juveniles were most numerous at the slackwater station at night. Threadfin shad and suckers were more abundant at night, while gizzard shade and drum were more abundant in day samples. Minnows and carp exhibited no diel periodicity. Recognizable (though not always identifiable) lower taxa in meter net collections accounted for roughly half of the species known to be resident in the river channel as adults. Apparently many riverine fishes either did not have planktonic immature stages or they tended to use extrariverine areas as spawning and/or nursery habitats. Generally, fishes which appeared in the spring (for example, gizzard shad, carp, buffalos, crappies, and percids) had short spawning periods and were more abundant in the higher-water year of the study (1977), whereas summer spawners (for example, some minnows, river carpsucker, and freshwater drum) had more protracted breeding seasons and were more abundant in the lower-water year. There was in inverse relationship between relative abundance of total ichthyoplankton and changing river stages.

81-000526 Haryu, T. LARVAL DISTRIBUTION OF WALLEYE POLLOCK, *THERAGRA CHALCOGRAMMA* (PALLAS), IN THE BERING SEA, WITH SPECIAL REFERENCE TO MORPHOLOGICAL CHANGES. *Bull. Fac. Fish. Hokkaido Univ.* 31(2):121-136. June 1980. SFA 26(1)
[Res. Inst. North Pac. Fish., Fac. Fish., Hokkaido Univ., Minato-cho, Hakodate 041, Japan] The distribution and morphology of walleye pollock [*Theragra chalcogramma* (Pallas)] larvae collected in surface larva net tows and mid-water trawls in the Bering Sea during June to August, 1970-1974, were studied. Pollock larvae were widely found over the Bering Sea, but were

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

81-000526 CONTINUED most abundant on the shelf region of the southeastern Bering Sea along the continental slope from Unimak Island to Cape Navarin. The larvae ranged in size from 5.1 mm to 97.1 mm long. The mean length was 16.3 mm in June and 18.9 mm in July. The July group had a wider deviation. Length-weight relationships were established. The data shows an inflection point at 7-8 mm size. The formulas are log W = 6.3694 log BL - 5.3227 for the size range of 5-8 mm fish and log W = 3.3512 log BL - 2.6283 for the size of the 8-39 mm fish. The inflection point corresponds with the appearance of the caudal fin rays. Pollock larvae were assigned to postlarval, juvenile and young stages primarily based upon the development of the fin rays. The fin rays reached the full number at about 22 mm in length, indicating a transition from postlarval stage to juvenile stage. In the southern part of the Bering Sea pollock larvae of late postlarval stage through uvenile stage were common, whereas in the northern part of the sea the larvae of early postlarval stage were predominant.

81-000527 Ikonen, E. MIGRATION OF RIVER-SPAWNING WHITEFISH IN THE GULF OF FINLAND. *Int. Counc. Explor. Sea* C.M. 1980/M:13. 11p. 1980. SFA 26(1)
[Finnish Game Fish. Res. Inst., P.O. Box 193, SF-00131, Helsinki 13, Finland]

81-000528 Lewis, R. E. and J. R. Siler. DETERMINATION OF THE VERTICAL DISTRIBUTION OF ICHTHYOPLANKTON IN LAKE NORMAN, NORTH CAROLINA, USING A DISCRETE-DEPTH SAMPLING DESIGN. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 91-100. Sept. 1980. SFA 26(1)
[Duke Power Environ. Sci. Unit, Rt. 4, Box 531, Huntersville, NC 28078] During 1977 and 1978 vertical distribution of larval shad (*Dorosoma* spp.), crappie (*Pomoxis* spp.), and percids (mostly *Perca flavescens*) in Lake Norman, North Carolina, varied with length of individuals in each taxon and water temperature. Dissolved oxygen concentration did not appear to influence the vertical distribution of the taxa studied. The discrete-depth sampling design, using 2.5-m depth increments, was adequate for comparing vertical distribution of larval fishes with physical variables. Although a precise estimate of larval fish density for the complete water column was not possible, changes in vertical distribution of ichthyoplankton were detected.

81-000529 Romanowsky, P. and K. Strawn. VERTICAL DISTRIBUTION OF CAGED ESTUARINE FISH IN THERMAL EFFLUENT SUBJECT TO GAS SUPERSATURATION. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:466-483. 1979(1980). SFA 26(1)
[La. Dep. Nat. Resour., Off. Environ. Affairs, Div. Water Pollut. Control, 400 Royal St., New Orleans 70130] Depth distribution of tarpon (*Megalops atlantica*), pinfish (*Lagodon rhomboides*), Atlantic croaker (*Micropogon undulatus*), black drum (*Pogonias cromis*), and striped mullet (*Mugil cephalus*) placed in cylindrical cages extending from the surface to the bottom of the thermal effluent of a steam-electric power plant was monitored daily using a depth locator. Temperature, conductivity, pH, dissolved oxygen, turbidity, and gas saturation levels were recorded immediately after recording the depth distribution data. Overall trends suggested that intraspecific interaction had an effect on fish distribution. Pinfish, black drum, and Atlantic croaker reacted to ambient light levels. Mean depth of pinfish, black drum, and striped mullet was shown to be significantly correlated with %-total gas saturation. Tarpon and black drum responded to temperature, croaker responded to conductivity, and striped mullet responded to %-oxygen saturation.

81-000530 Summers, G. L. SEASONAL DISTRIBUTION OF ADULT WALLEYE AS DETERMINED BY ULTRASONIC TELEMETRY IN CANTON RESERVOIR, OKLAHOMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:611-619. 1979(1980).

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

81-000530 CONTINUED SFA 26(1)
[Okla. Fish. Res. Lab., 1416 Planck, Norman 73069] Ultrasonic transmitters were surgically implanted into 50 sexually mature walleye *Stizostedion vitreum vitreum* (mean weight 1.9 kg) in Canton Reservoir during March 1977. The locations of these fish were determined bimonthly from March through November 1977, as an indication of walleye concentration areas in the reservoir. Temperature, dissolved oxygen and pH profiles were also obtained bimonthly at 2 stations during this time. During the March spawning season walleye were all located near the riprap of the dam. The rest of the year the fish showed a preference for areas near submerged islands. There was also a tendency for the walleye to concentrate farther upstream along the perimeters of these islands as the year progressed. This apparent upstream movement by transmitter-equipped walleye may have been related to low dissolved oxygen concentrations near the bottom in the deeper portion of the reservoir during the summer months. However, no correlation was found between walleye locations throughout the year and the measured environmental parameters.

81-000531 Van Den Avyle, M. J. and D. D. Fox. DIEL, VERTICAL, AND HORIZONTAL VARIATIONS IN ABUNDANCE OF LARVAL *DOROSOMA* SPP. IN CENTER HILL RESERVOIR, TENNESSEE. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 116-122. Sept. 1980. SFA 26(1)
[Tenn. Coop. Fish. Res. Unit, Tenn. Technol. Univ., Cookeville 38501] Larval *Dorosoma* spp. were collected at five depths from one midchannel station and from the surface at two inshore stations during May and June 1979. Collections were made six times during each of three 24-h periods. Catches were highest at night and lowest at midday, and the larvae were always most abundant in the surface or 2-m samples. Diel variations in catch rates were believed to result primarily from changes in catchability rather than vertical migrations. Midchannel densities were lower than shoreline or nearshore densities during two of the three sampling periods. Median lengths of shad larvae showed no consistent vertical or diel patterns, but specimens collected along the shoreline were usually shorter than those collected at the midchannel station.

81-000532 Weinstein, M. P.; S. L. Weiss; R. G. Hodson and L. R. Gerry. RETENTION OF THREE TAXA OF POSTLARVAL FISHES IN AN INTENSIVELY FLUSHED TIDAL ESTUARY, CAPE FEAR RIVER, NORTH CAROLINA. *NOAA Fish. Bull.* 78(2):419-436. Apr. 1980. SFA 26(1)
[Dep. Biol., Va. Commonwealth Univ., Richmond 23284] Fixed nets were used to sample postlarvae of spot, *Leiostomus xanthurus*, Atlantic croaker, *Micropogonias undulatus*, and flounders, *Paralichthys* spp., over several 24-hour periods in the Cape Fear River, near Wilmington, North Carolina. Results of analyses of variance on abundance data collected at two locations indicate that these taxa exhibit distinct behavioral responses, primarily to photo-periods and tide, which allow them to maintain a selected position in the estuary and avoid being flushed seaward. The level of response to these variables dictates ultimate residence in at least two primary nurseries, the river main stem in the vicinity of the salt boundary and the tidal salt marshes. By migrating to the surface at night, both spot and flounders make apparent use of tides to augment lateral migration into marshes. Conversely, by tending to reamin more bottom oriented at all times, Atlantic croaker accumulate in greater numbers in deep water at the head of the estuary.

FOODS/FEEDING

81-000533 Alvariño, A. THE RELATION BETWEEN THE DISTRIBUTION OF ZOOPLANKTON PREDATORS AND ANCHOVY LARVAE. *Calif. Coop. Oceanic Fish. Invest.* 21:150-160. July 1980. SFA 26(1)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

FOODS/FEEDING (CONTINUED)

81-000534 Ames, J. A. and G. V. Morejohn. EVIDENCE OF WHITE SHARK, *CARCHARODON CARCHARIAS*, ATTACKS ON SEA OTTERS, *ENHYDRA LUTRIS*. *Calif. Fish Game* 66(4):196-209. Oct. 1980. SFA 26(1)
[Mar. Res. Br., Calif. Dep. Fish Game, 2201 Garden Rd., Monterey 93940]

81-000535 Arawomo, G. A. O. THE FOOD OF JUVENILE TROUT, *SALMO TRUTTA* L., IN LOCH LEVEN, KINROSS, SCOTLAND. *Hydrobiologia* 75(1):49-56. 4 Oct. 1980. SFA 26(1)
[Dep. Biol., Univ. Ife, Ile-Ife, Nigeria] The food of juvenile brown trout in Loch Leven was studied by the examination of 662 stomachs of fish caught between October 1974 and December 1976. The food consumption was estimated only on the basis of the analysis of the stomach contents. The main food items of juvenile trout in the loch are chironomids, crustaceans and nematodes: these are abundant in the offshore mud zone of the loch.

81-000536 Barger, L. E. and R. V. Kilambi. FEEDING ECOLOGY OF LARVAL SHAD, *DOROSOMA*, IN BEAVER RESERVOIR, ARKANSAS. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 136-145. Sept. 1980. SFA 26(1)
[NMFS, SEFC, Panama City, FL 32407] Larvae of threadfin and gizzard shad collected by midwater trawl were pooled for this study. Plankton samples were obtained by a metered Miller sampler with a #10 net on the same or adjacent day of trawl samples. All the collections were made at weekly intervals from 17 May to 28 June 1972. Gut contents of 547 larval shad were analyzed. This study showed that zooplankton was the primary food of larval shad. Relative abundance of zooplankters in larval shad diet and Ivlev's electivity index indicated that smaller shad (5 to 11 mm) consumed *Cyclops*, and with increase in larval size (14 mm and above) the diet was comprised of *Bosmina*, *Ceriodaphnia*, and finally rotifers (*Keratella*). Diet of 35-mm shad was exclusively *Pediastrum*.

81-000537 Barton, B. A. and B. F. Bidgood. COMPETITIVE FEEDING HABITS OF RAINBOW TROUT, WHITE SUCKER AND LONGNOSE SUCKER IN PAINE LAKE, ALBERTA. *Alberta Dep. Energy Nat. Resour. Fish. Res. Rep.* No. 16. Mar. 1980.
Competition for food between two resident sucker populations and introduced rainbow trout in Paine Lake was evident during the summer of 1977. Cladocerans, mostly *Daphnia*, were the major food item for all three species, particularly in July and August, being 15.9% of the total food volume present in rainbow trout diet, 33.7% of white sucker diet and 74.2% of longnose sucker diet for the 4-month study period. Tendipedidae larvae were also important in the diet of the three species in 1977 contributing 18.3% to food volume in rainbow trout, 21.0% to food volume in white sucker and 4.7% to food volume in longnose sucker. Certain food items present in rainbow trout stomachs (Hymenoptera, 17.3%; Coleoptera, 6.2%; Tendipedidae pupae, 11.9%) were scarce or absent in sucker diets. When these food items were not available for rainbow trout, there was direct competition between trout and suckers for *Daphnia* and chironomid larvae. Feeding selectivity for *Daphnia* by all three species was apparent since copepods, which were also common in the lake, were virtually absent in the fish stomachs.

81-000538 Baskin, J. N.; T. M. Zaret and F. Mago-Leccia. FEEDING OF REPORTEDLY PARASITIC CATFISHES (*TRICHOMYCTERIDAE* AND *CETOPSIDAE*) IN THE RIO PORTUGUESA BASIN, VENEZUELA. *Biotropica* 12(3):182-186. Sept. 1980. SFA 26(1)
[Biol. Sci. Dep., Calif. State Polytech. Univ., Pomona 91768] The stomach contents of several Trichomycteridae and Cetopsidae were examined from wet-season collections in the Portuguesa River basin, Venezuela. Collections were from piedmont, high llanos, and low llanos habitats. Based on these and other published and unpublished observations the species were classified

FOODS/FEEDING (CONTINUED)

81-000538 CONTINUED according to feeding habits. Among the trichomycterids, *Trichomycterus kneri* and *T. meridae* feed only on benthic insects, *Vandellia* feeds only on blood of fishes and other vertebrates, and Stegophilinae (*Stegophilus*, *Homodiaetus*, and *Ochmacanthus*) are tentatively classified as scale eaters. The only cetopsid species taken contained terrestrial-winged insects. Cetopsids are also schooling piscivores, but none are confirmed to be parasites. Both cetopsids and trichomycterids bear the common name candiru or carnero, but their feeding habits do not indicate close phylogenetic relationship. Three parasitic species were found in the piedmont and four in the high llanos, but in the low llanos, where the greatest variety of fishes was found, only *Ochmacanthus* occurred.

81-000539 Bleckmann, H. REACTION TIME AND STIMULUS FREQUENCY IN PREY LOCALIZATION IN THE SURFACE-FEEDING FISH *APLOCHEILUS LINEATUS*. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 140(2):163-172. Nov. 1980. SFA 26(1)
[Inst. Tierphysiol., Wartweg 95, D-6300 Giessen, West Germany]

81-000540 Bowman, R. E. and E. W. Bowman. DIURNAL VARIATION IN THE FEEDING INTENSITY AND CATCHABILITY OF SILVER HAKE (*MERLUCCIUS BILINEARIS*). *Can. J. Fish. Aquatic Sci.* 37(10):1565-1572. Oct. 1980. In English with French summ. SFA 26(1)
[NMFS, Woods Hole Lab., Woods Hole, MA 02543]

81-000541 Brostoff, W. N. and M. A. Hixon. ALGAL SUCCESSION ON HAWAIIAN REEFS: THE ROLE OF HERBIVOROUS FISHES. *Am. Zool.* 20(4):822. 1980. Abstract only. SFA 26(1)
[Univ. Hawaii, Manoa]

81-000542 Christie, W. J. and D. P. Kolenosky. PARASITIC PHASE OF THE SEA LAMPREY (*PETROMYZON MARINUS*) IN LAKE ONTARIO. *Can. J. Fish. Aquatic Sci.* 37(11):2021-2038. Nov. 1980. In English with French summ. SFA 26(1)
[Ontario Minist. Nat. Resour., Glenora Fish. Stn., Picton, ON K0K 2T0 Canada]

81-000543 Clarke, D. G. ASPECTS OF RESOURCE UTILIZATION IN THE FRECKLED BLENNY, *HYPSOBLENNIUS IONTHAS* (TELEOSTEI: BLENNIIDAE), ON OYSTER REEF SUBSTRATE. *Ph.D. dissertation, Univ. Ala.* 147p. 1979. From Diss. Abstr. Int. B Sci. Eng. 41(6):2042. Dec. 1980. SFA 26(1)

81-000544 Conway, D. V. P. THE FOOD OF LARVAL BLUE WHITING, *MICROMESISTIUS POUTASSOU* (RISSO), IN THE ROCKALL AREA. *J. Fish Biol.* 16(6):709-723. June 1980. SFA 26(1)
[Nat. Environ. Res. Council, Inst. Mar. Environ. Res., Prospect Place, The Hoe, Plymouth PL1 3DH, England] Larval blue whiting of 3-42 mm total length, taken in 1967 and 1968 in the Rockall Bank area, were found to have fed almost exclusively on various stages of small crustaceans; the eggs, nauplii and copepodites of copepods, along with fewer numbers of larval euphausiids and *Evadne nordmanni*, formed the major proportion of the diet. The guts of the larger larvae contained a greater number of, and larger organisms, than those of the smaller larvae. Feeding incidence was generally lower at night. There was a general increase in the weight of the gut contents as the daylight hours progressed followed by a decrease during the night. Diurnal variation in the percentage composition of the food was also demonstrated. Comparisons of the diet in the two years showed that more food was comsumed

FOODS/FEEDING (CONTINUED)

81-000544 CONTINUED by almost all sizes of larvae in 1968. It has previously been suggested that blue whiting larvae may find better feeding conditions on Rockall Bank than off the Bank. However the present study suggests that larvae, particularly of 8 mm and longer, took more food when off the Bank. A brief comparison is made of the gut contents of the larvae of blue whiting and of the other eight most abundant species.

81-000545 Cook, S. B. SUNFISH-SNAIL INTERACTIONS: ESCAPE RESPONES OF SNAIL PREY. *Am. Zool.* 20(4):810. 1980. Abstract only. SFA 26(1)

[Ohio State Univ., Columbus] Behavioral responses of prey to predators may well be correlated with the probability of predation. To test this hypothesis, I examined the behavioral response of three snail species, *Physa integra, Helisoma anceps* and *Oxytrema semicarinata* (listed in order of decreasing susceptibility to predation by the redear sunfish *Lepomis microlophus*) to crushed snail extract and water from sunfish tanks. Neither *P. integra* nor *O. semicarinata* exhibited escape behaviors. In contrast, *H. anceps* gave population-specific responses. *Helisoma* from a predator-free stream were equally responsive to snail extract and control water while snails from a lake containing redears were more likely (compared to controls) to bury in the substrate or crawl out of the water when exposed to extract. *H. anceps* from both areas were insensitive to predator water. In this system therefore, escape responses of prey were not strictly related to susceptibility to fish predation.

81-000546 Dauble, D. D.; R. H. Gray and T. L. Page. IMPORTANCE OF INSECTS AND ZOOPLANKTON IN THE DIET OF 0-AGE CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) IN THE CENTRAL COLUMBIA RIVER. *Northwest Sci.* 54(4):253-258. Nov. 1980. SFA 26(1)

[Ecosyst. Dep., Battele Pac. Northwest Lab., Richland, WA 99352] Feeding habits of 0-age chinook salmon (*Oncorhynchus tshawytscha*), collected in the Hanford Reach of the Columbia River, were evaluated from March through July, 1976. Food items in chinook guts were compared to potential food organisms in the Columbia River. Aquatic insects formed the bulk of the diet. Midge fly (Chironomidae) larvae and pupae accounted for 78 percent by number and 59 percent by volume of the total ingested items. Consumption of immature insects was greatest during March-June, whereas caddisfly adults were important food items in June and July. The cladoceran, *Daphnia schodleri*, was numberically and volumetrically important during the latter part of the study period. There was little size-related difference in diet, although chinook fry longer than 66 mm (FL) preyed mainly on caddisfly adults (7 percent number, 64 percent volume) and cladocerans (70 percent number, 13 percent volume). Chironomidae larvae dominated benthic samples in April and June with Trichoptera larvae in lesser abundance. Midstream zooplankton tows collected primarily Copepoda.

81-000547 Deppert, D. L. and J. B. Mense. EFFECT OF STRIPED BASS PREDATION ON AN OKLAHOMA TROUT FISHERY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:384-392. 1979(1980). SFA 26(1)

[Okla. Dep. Wildl. Conserv., Fish. Res. Lab., Norman 73069] A creel survey was conducted on the lower Illinois River, Oklahoma, during 1977. Striped bass (*Morone saxatilis*) were also collected for food habit information and their relative abundance was noted. Striped bass predation on rainbow trout (*Salmo gairdneri*) occured only at the downstream sampling site and only for the 1-week period following trout stocking. Trout made up 40% of the food items of these striped bass within 1 week after trout stocking. The trout fishery of the lower Illinois River has declined in overall intensity since 1965, particularly in the downstream reaches. However, the warm-water fishery, particularly for striped bass, has increased dramatically.

FOODS/FEEDING (CONTINUED)

81-000548 Fulton, R. S. III. CRYPTIC COPEPODS, FISH FORAGING BEHAVIOR, AND LITTORAL REFUGIA. *Am. Zool.* 20(4):810. 1980. Abstract only. SFA 26(1)

[Duke Univ. Mar. Lab., Beaufort, NC] Of the planktonic calanoid copepods inhabiting the estuaries near Beaufort, N. C., only *Pseudodiaptomus coronatus* appears unaffected by the high levels of fish predation in eelgrass beds. In fact *Pseudodiaptomus* is found in much higher densities in these littoral areas than in adjacent unvegetated habitats. This is in spite of the fact that it is a rather large, heavily pigmented copepod, characteristics that would be expected to make it highly preferred by planktivorous fish. Laboratory experiments with the two most important predators, silversides (*Menidia menidia*) and pinfish (*Lagodon rhomboides*), demonstrate that *Pseudodiaptomus* is protected in its preferred habitat by its epibenthic habit and its cryptic coloration. The two fish species show differences in prey preferences due to different foraging behaviors.

81-000549 Gasaway, R. D. BENTHIC MACROINVERTEBRATE RESPONSE TO GRASS CARP INTRODUCTION IN THREE FLORIDA LAKES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:549-562. 1979(1980). SFA 26(1)

[Fla. Game Fresh Water Fish Comm., Tallahassee] Three natural lakes were studied to determine effects of grass carp (*Ctenopharyngodon idella* Val.) introduction on invertebrates. Benthic macroinvertebrate populations were changed after the introduction of grass carp changed the existing habitat in the 3 natural lakes. Species diversity (d), number of taxa and pollution-intolerant organisms decreased in all lakes after grass carp introduction. Macrophytes were also reduced in all study areas and several native species were eliminated. Changes in benthos corresponded to changes in water quality and aquatic vegetation.

81-000550 Grossman, G. D. ECOLOGICAL ASPECTS OF ONTOGENETIC SHIFTS IN PREY SIZE UTILIZATION IN THE BAY GOBY (PISCES: GOBIIDAE). *Oecologia* 47(2):233-238. 1980. SFA 26(1)

[Dep. Wildl. Fish. Biol., Univ. Calif., Davis 95616] Two age classes (0+ to 3+ and 4+ to 7+) of bay gobies (*Lepidogobius lepidus* Girard) differed in the sizes of whole prey (except polychaetes) recovered from the digestive tract. Although older fish comsumed greater amounts of larger prey they did not capture larger individuals of a given prey type for seven of nine prey classes. The remaining two, harpacticoid copepods and ostracods contributed minimally to ontogenetic differences. The switch to larger prey appears to either decrease exposure to predation through a reduction in foraging time or increase energy intake. This is facilitated through older fishes greater size and/or superiority in intraspecific competition. These differences can probably be viewed as adaptations to selective pressures imposed by fluctuating food resources on predation levels in bays and estuaries.

81-000551 Guillory, V. ANALYSIS OF PREY SELECTION IN CHAIN PICKEREL. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:507-517. 1979(1980). SFA 26(1)

[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle 70358]

81-000552 Hendricks, M. K. and R. L. Noble. FEEDING INTERACTIONS OF THREE PLANKTIVOROUS FISHES IN TRINIDAD LAKE, TEXAS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:324-330. 1979(1980). SFA 26(1)

[Dep. Bioeng., Biosyst. Res. Div., Tex. A&M Univ., College Station 77843] Food habits of gizzard shad (*Dorosoma cepedianum*), threadfin shad (*D. petenense*), and blue tilapia (*Tilapia aurea*) were studied in summer and winter, 1975. Stomach contents of all 3 species consisted predominantly of organic detritus, followed by green algae, blue-green algae and diatoms. Occurrence of planktonic foods corresponded closely with the composition of the plankton. Although food habits differed between season, they were closely correlated among species within season. Similarities in food habits of the 3 planktivorous species suggest potential food competition.

FOODS/FEEDING (CONTINUED)

81-000553 Hopkins, J. A. and M. K. Hancock. DIEL FEEDING PATTERN AND PREY OF THE PACIFIC SANDDAB *(CITHARICHTHYS SORDIDUS). Am. Zool.* 20(4):950. 1980. Abstract only. SFA 26(1)
[Calif. State Univ., Long Beach]

81-000554 Hortle, M. E. and R. W. G. White. DIET OF *PSEUDAPHRITIS URVILLII* (CUVIER & VALENCIENNES) (PISCES: BOVICHTHYIDAE) FROM SOUTH-EASTERN TASMANIA. *Aust. J. Mar. Freshwater Res.* 31(4):533-539. Sept. 1980. SFA 26(1)
[R.W.G. White: Dep. Zool., Univ. Tasmania, Box 252C, G.P.O., Hobart, Tasmania 7001, Australia] Numerical and volumetric analyses were conducted on the gut contents of 698 specimens of *P. urvillii* taken from 10 streams in south-eastern Tasmania. *P. urvillii* is shown to be a generalized carnivore eating a wide range of benthic animals. Information is given on the variation in the diet with season and fish size. A comparison is made of the diets of fish from estuarine and freshwater sites on one river.

81-000555 Houde, E. D. and R. C. Schekter. FEEDING BY MARINE FISH LARVAE: DEVELOPMENTAL AND FUNCTIONAL RESPONSES. *Environ. Biol. Fishes* 5(4):315-334. 8 Dec. 1980. SFA 26(1)
[Rosenstiel Sch. Mar. Atmos. Sci., Univ. Miami, 4600 Rickenbacker Causeway, Miami, FL 33149] The relationship between prey consumption rate and prey concentration (functional response), and its change with growth (developmental response) were examined in the laboratory for three species of marine fish larvae: bay anchovy *Anchoa mitchilli* (Engraulidae), sea bream *Archosargus rhomboidalis* (Sparidae) and lined sole *Achirus lineatus* (Soleidae). The major objective was to determine relative predatory abilities of the larvae by fitting feeding rate data to developmental and functional response models. Feeding success, prey capture success, attack rates, handling times and search rates were estimated. Prey consumption rates and attack rates of bay anchovy usually were highest, but at the lowest prey level (50 per liter) first-feeding sea bream larvae had the highest consumption rate. Sea bream could consume prey at near-maximum rates at prey levels lower than those required by the other species. As larvae grew, time searching per attack decreased rapidly for all species, especially at low prey levels. Handling time also decreased, but most rapidly for bay anchovy. Search rates were highest for bay anchovy and lowest for lined sole. Bay anchovy had the best apparent predation ability, but when previous results on larval growth rates, survival rates and growth efficiencies were considered, sea bream larvae were the most efficient predators and the least likely of the three species to be limited by low prey levels.

81-000556 Hudd, R. FEEDING OF BALTIC HERRING LARVAE IN THE GULF OF FINLAND. *Int. Counc. Explor. Sea* C.M. 1980/J:7. 14p. 1980. SFA 26(1)
[Finish Game Fish. Res. Inst., Vaasa Field Stn., Rantakatu 28, SF-65120, Vaasa 12, Finland] Baltic herring larvae in the Gulf of Finland have absorbed all the yolk in the yolk sac by the time they reach a length of 9 mm. Intake of external food does not usually begin before the yolk has been absorbed. Absorption is faster later in the summer, when the water is warmer. The feeding habits of the larvae show a clear diel rhythm. Larvae of all sizes eat during the light period and in the illuminated upper water layers, appearing to be unaffected by the diel vertical migration of their food organisms. The most important food is copepods of different stages, but in spring when the water is colder the larvae eat less motile organisms, such as rotifers and planktonic eggs. The size of the food organisms increases with the size of the larvae, but bigger larvae also eat smaller organisms, such as nauplii. At a rough estimate, larvae up to 16 mm eat about 5 mg a day.

81-000557 Hyslop. E. J. STOMACH CONTENTS ANALYSIS - A REVIEW OF METHODS AND THEIR APPLICATION. *J. Fish Biol.* 17(4):411-429. Oct. 1980. SFA 26(1)
[Biol. Dep., Open Univ., Walton Hall, Melton Keynes MK7 4AA,

FOODS/FEEDING (CONTINUED)

81-000557 CONTINUED Buckinghamshire, England] Methods for analysing fish stomach contents are listed and critically assessed with a view to their suitability for determining dietary importance - this term is defined. Difficulties in the application of these methods are discussed and, where appropriate, alternative approaches proposed. Modifications which have practical value are also considered. The necessity of linking measurements of dietary importance to stomach capacity is emphasized and the effects of differential digestion upon interpretation of stomach contents outlined. The best measure of dietary importance is proposed as one where both the amount and bulk of a food category are recorded.

81-000558 Irvine, G. V. FISH AS FARMERS: AN EXPERIMENTAL STUDY OF HERBIVORY IN A TERRITORIAL CORAL REEF DAMSELFISH. *Am. Zool.* 20(4):822. 1980. Abstract only. SFA 26(1)
[Univ. Calif., Santa Barbara]

81-000559 Ivanova, M. N. and A. N. Lopatko. DETERMINING DIET IN PREDATORY FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):157-160. 1979. SFA 26(1)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl' Reg., USSR]

81-000560 Jenkins, R. M.; C. A. Schultz and W. M. Seawell. BARKLEY LAKE SYMPOSIUM. PREY-PREDATOR RELATIONS IN CROOKED CREEK BAY, BARKLEY LAKE, KENTUCKY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:692-702. 1979(1980). SFA 26(1)
[U.S. FWS, Fayetteville, AR 72701] Available prey-predator ratios (AP/P) in Crooked Creek Bay indicated a deficiency of prey for predators (largemouth bass equivalents) 200 mm long (total length) or less. Analysis of samples collected after the application of rotenone to small coves led to overestimates of available prey. Application of adjustment factors to account for differences in fish distribution in coves and in open water improved AP/P estimates based on small-cove samples. After reviewing previous food studies, we redefined crappies longer than 210 mm and catfishes longer than 390 mm as predators. Revised AP/P calculations then indicated no shortage of prey in the Bay. Comparison of these data with those from a 1965 study in Douglas Lake, Tennessee, showed that predators in Douglas Lake were more efficient in cropping available prey. This higher efficiency might have been due to greater water clarity, lack of threadfin shad, or inefficient recovery of small clupeids in the deep, open waters of Douglas Lake.

81-000561 Johnson, B. G. H. PREDATORY-PHASE SEA LAMPREYS (*PETROMYZON MARINUS*) IN THE GREAT LAKES. *Can. J. Fish. Aquatic Sci.* 37(11):2007-2020. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Fish. Oceans, Sea Lamprey Control Cent., Sault Ste. Marie, ON P6A 1P0, Canada]

81-000562 Keast, A. FOOD AND FEEDING RELATIONSHIPS OF YOUNG FISH IN THE FIRST WEEKS AFTER THE BEGINNING OF EXOGENOUS FEEDING IN LAKE OPINICON, ONTARIO. *Environ. Biol. Fishes* 5(4):305-314. 8 Dec. 1980. SFA 26(1)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada]

81-000563 King, E. L., Jr. CLASSIFICATION OF SEA LAMPREY (*PETROMYZON MARINUS*) ATTACK MARKS ON GREAT LAKES LAKE TROUT (*SALVELINUS NAMAYCUSH*). *Can. J. Fish. Aquatic Sci.* 37(11):1989-2006. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Hammond Bay Biol. Stn., Millersburg, MI 49759]

FOODS/FEEDING (CONTINUED)

81-000564 Kinnunen, R. E. HISTOPATHOLOGY OF SEA LAMPREY (*PETROMYZON MARINUS*) WOUNDS IN RAINBOW TROUT. *M.S. thesis, Mich. State Univ.* 135p. 1979. From Masters Abstr. 18(4):258. Dec. 1980. SFA 26(1)

81-000565 Last, J. M. THE FOOD OF TWENTY SPECIES OF FISH LARVAE IN THE WEST-CENTRAL NORTH SEA. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 60. 44p. 1980. SFA 26(1)
[Fish. Lab., Lowestoft, England]

81-000566 Lauder, G. V. THE SUCTION FEEDING MECHANISM IN SUNFISHES (*LEPOMIS*): AN EXPERIMENTAL ANALYSIS. *J. Exp. Biol. (Cambridge Univ. Press)* 88:49-72. Oct. 1980. SFA 26(1)
[Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138]

81-000567 Lawrie, A. H. INTERACTIONS BETWEEN SEA LAMPREY (*PETROMYZON MARINUS*) AND THEIR FORAGE BASE. A REPORT FROM THE SLIS STOCK EFFECTS TASK FORCE. *Can. J. Fish. Aquatic Sci.* 37(11):2193-2196. Nov. 1980. In English with French summ. SFA 26(1)
[Ontario Minist. Nat. Resour., P.O. Box 50, Maple, ON L0J 1E0, Canada]

81-000568 Layher, W. G. and R. J. Boles. FOOD HABITS OF THE FLATHEAD CATFISH, *PYLODICTIS OLIVARIS* (RAFINESQUE), IN RELATION TO LENGTH AND SEASON IN A LARGE KANSAS RESERVOIR. *Trans. Kans. Acad. Sci.* 83:200-214. 1980. SFA 26(1)
[Okla. Coop. Fish. Res. Unit, Life Sci. West 433, Okla. State Univ., Stillwater 74074] Frequency of occurrence, numbers, and volumes of organisms in stomachs of various age and size groups of 172 flathead catfish (*Pylodictis olivaris*) from Milford Reservoir in northcentral Kansas were determined for each month from April through November 1975. Flathead catfish between 201 and 500 mm consumed mostly benthic macroinvertebrates and fishes, while those over 500 mm almost exclusively ate gizzard shad (*Dorosoma cepedianum*). Diets of piscivorous flathead catfish appeared to shift seasonally. Two-year-old flathead catfish relied heavily on large benthic macroinvertebrates such as crayfish (*Orconectes* sp.) but this dependence decreased gradually until age six, when the flathead catfish were almost entirely piscivorous. Changes in food habits may be related to physical size of the predator and physical exclusion from habitat occupied by crayfish. The flathead catfish did not prey actively on rough fish populations, probably because gizzard shad of small size were readily available. The relatively fast growth of flathead catfish in Milford Reservoir suggests that an abundance of forage fishes limited competition for food.

81-000569 Maitland, P. S. SCARRING OF WHITEFISH (*COREGONUS LAVARETUS*) BY EUROPEAN RIVER LAMPREY (*LAMPETRA FLUVIATILIS*) IN LOCH LOMOND, SCOTLAND. *Can. J. Fish. Aquatic Sci.* 37(11):1981-1988. Nov. 1980. In English with French summ. SFA 26(1)
[Inst. Terrestrial Ecol., 78 Craighall Rd., Edinburgh EH6 4RQ, Scotland]

81-000570 Mathavan, S.; J. Muthukrishnan and G. A. Heleenal. STUDIES ON PREDATION ON MOSQUITO LARVAE BY THE FISH *MACROPODUS CUPANUS*. *Hydrobiologia* 75(3):255-258. 6 Nov. 1980. SFA 26(1)
[Sch. Biol. Sci., Madurai Kamaraj Univ., Madurai-625 021, India] Maximum Reactive Distance (RDmax) and the area of the Reactive Perceptual Field (RPF) for the fish *Macropodus cupanus* were determined, using the fourth instar mosquito larva (*Culex fatigans*) as the prey organism. RDmax and the area of RPF increased with increasing body weight of the fish as well as increasing food deprivation time. Satiation time (St) as a function of the

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81-000570 CONTINUED weight of the fish and aquarium temperature were also determined. In larger W classes (570 and 270 mg) St was not influenced by temperature. To get satiated the smallest W class (80 mg) required feeding periods of 40, 30 and 20 minutes at 22 or 27, 32 and 37°C, respectively.

81-000571 Mauchline, J. and J. D. M. Gordon. THE FOOD AND FEEDING OF THE DEEP-SEA MORID FISH *LEPIDION EQUES* (GUNTHER, 1887) IN THE ROCKALL TROUGH. *J. Mar. Biol. Assoc. U.K.* 60(4):1053-1059. Nov. 1980. SFA 26(1)
[Dunstaffnage Mar. Res. Lab., Oban, Scotland] The stomach contents of *Lepidion eques* trawled at depths ranging from 500 to 1250 m on the Hebridean Terrace (56°-57° N, 9°-11° W) are analysed relative to size of fish, depth of habitat and season of the year. Of the 1281 fish examined, 47% had everted stomachs, 29% empty stomachs, 2% had food that was totally unrecognizable while 21% had food whose constituents could be identified. The principal dietary components are the epibenthic and hyperbenthic decapod crustaceans, although a wide variety of other organisms also occur as minor components. Benthic infauna and sessile epifauna are absent from the diet. *L. eques* therefore feed predominantly on organisms swimming immediately above the sea-bed or actively moving over it.

81-000572 McGowan, J. A. and C. B. Miller. LARVAL FISH AND ZOOPLANKTON COMMUNITY STRUCTURE. *Calif. Coop. Oceanic Fish. Invest.* 21:29-36. July 1980. SFA 26(1)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093]

81-000573 Miller, A. C. DIFFERENTIAL FEEDING ACITIVITY BY THE SURGEONFISH, *ACANTHURUS TRIOSTEGUS*, AT ENEWETAK ATOLL. *Am. Zool.* 20(4):950. 1980. Abstract only. SFA 26(1)
[Calif. State Univ., Long Beach]

81-000574 Miroshnichenko, M. P. THE STATE AND DEGREE OF UTILIZATION OF BOTTOM FOOD RESOURCES BY BENTHOS-EATING FISH FROM TSIMLYANSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):70-78. 1979. SFA 26(1)
[GosNIORKh, USSR]

81-000575 Moore, J. D. and T. J. Lynchwick. CHANGES IN MORTALITY OF LAKE TROUT (*SALVELINUS NAMAYCUSH*) IN RELATION TO INCREASED SEA LAMPREY (*PETROMYZON MARINUS*) ABUNDANCE IN GREEN BAY, 1974-78. *Can. J. Fish. Aquatic Sci.* 37(11):2052-2056. Nov. 1980. In English with French summ. SFA 26(1)
[Lake Mich. Fish. Stn., Sturgeon Bay, WI 54235]

81-000576 Moore, J. W. and J. M. Mallatt. FEEDING OF LARVAL LAMPREY. *Can. J. Fish. Aquatic Sci.* 37(11):1658-1664. Nov. 1980. In English with French summ. SFA 26(1)
[Alberta Environ. Cent., Bag 4000, Vegreville, AB T0B 4L0, Canada]

81-000577 Muller, M.; J. W. M. Osse and J. L. van Leeuwen. THE GILL COVER IN SUCTION FEEDING OF TELEOSTS. *Am. Zool.* 20(4):930. 1980. Abstract only. SFA 26(1)
[Agric. Univ., Wageningen, The Netherlands]

81-000578 Nagy, S. CONTRIBUTION TO THE KNOWLEDGE OF THE FOOD OF GRAYLING (*THYMALLUS THYMALLUS*) IN THE BELÁ RIVER (WESTERN TATRA MTS.). *Folia Zool.* 29(2):185-192. 1980. In English with Russian summ. SFA 26(1)

FOODS/FEEDING (CONTINUED)

81-000578 CONTINUED
[Lab. Fish Hydrobiol., Bratislava, Czechoslovakia] The paper deals with the results obtained in studies of the qualitative and quantitative composition of natural food eaten by grayling in the lower course of the Belá River (Western Tatra Mts.), carried out in late spring and early summer. Analyses involved stomach contents of 112 individuals 113-317 mm in size. Benthic invertebrates, especially larvae of aquatic insect, were the dominant component of the food. Extra-aquatic components of food were represented only scarcely due to the absence of grassland and/or forest biotopes in the close neighbourhood of the river. In the food of one to three-year-old graylings, smaller food components predominated [above all, larvae of chironomid midges (*Chironomidae*)] while greater forms were more frequent in that four to five-year-old individuals [above all, caddis worms (*Trichoptera*)]. There were no significant differences in the ratio of benthic to extra-aquatic food components in the food of grayling belonging to the different age categories. The obtained results corroborate data published by other authors on the high feeding activity and impartial habits of foraging graylings.

81-000579 Nilsson, N.-A. FOOD AND HABITAT OF THE FISH COMMUNITY OF THE OFFSHORE REGION OF LAKE VÄNERN, SWEDEN. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 126-139. 1979. SFA 26(1)
[Inst. Freshwater Res., S-170 11 Drottningholm, Sweden]

81-000580 Nyberg, P. PRODUCTION AND FOOD COMSUMPTION OF PERCH, *PERCA FLUVIATILIS* L., IN TWO SWEDISH FOREST LAKES. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 140-157. 1979. SFA 26(1)
[Inst. Freshwater Res., S-170 11 Drottningholm, Sweden] The purpose of the present investigation has been to study the production and food comsumption of perch (*Perca fluviatilis* L.) in two small (2.9 and 9.7 ha respectively) forest lakes in Sweden. The lakes investigated are oligotrophic, with rather acid and brownish water. The fish population in Lake Vitalampa consists only of perch; that of Lake Botjärn also includes occasional pike (*Esox lucius* L.). During the five years 1970-74, production was 0.7-1.2 g/m^2 and 1.3-2.7 g/m^2/year (wet weight) for Lakes Vitalampa and Lake Botjärn, respectively. The highest production values were as a rule recorded for the years when the newly-hatched fry were particularly numerous. In Lake Vitalampa, the production of the older fish (>2+) was calculated to consist to approximately 50% of sexual products. The annual food consumption was calculated with the aid of respiration experiments, under the assumption that 80% of the food consumed can be assimilated. The food consumption of the perch population during 1974 was calculated to be 320 kg/ha in Lake Botjärn and 136 kg/ha in Lake Vitalampa (wet weight). Some 75% of this amount was consumed during growth season (approximately 4 months). The predation on bottom fauna in Lake Vitalampa was very intensive, whereas the perch were only to a very small extent able to utilize the large zooplankton production in that lake.

81-000581 Pearson, W. H.; S. E. Miller and B. L. Olla. CHEMORECEPTION IN THE FOOD-SEARCHING AND FEEDING BEHAVIOR OF THE RED HAKE, *UROPHYCIS CHUSS* (WALBAUM). *J. Exp. Mar. Biol. Ecol.* 48(2):139-150. 18 Nov. 1980. SFA 26(1)
[Battelle Pac, Northwest Lab., Mar. Res. Lab., Sequim, WA 98382] Behavioral observatrions were made of hake, *Urophycis chuss* (Walbaum), presented with a freeze-dried clam extract over a wide concentration range. The salient food searching behaviors observed were emerging from shelter, swimming, and extending the chemosensitive modified pelvic fins over the bottom. Some fish also snapped at the source of extract-laden sea water. As the extract concentration increased, the three food searching behaviors occureed in more individuals and more concurrently in the same individuals. Above 10^{-9} g/l, the percentage of hake showing the three food-searching behaviors and snapping increased linearly with the logarithm of the extract concentration. Detection was inferred from emergence from shelter or extension of pelvic

FOODS/FEEDING (CONTINUED)

81-000581 CONTINUED fins. The threshold concentration at which 50% of the hake showed the behaviors indicating detection was 10^{-8} g/1. The thresholds for food searching and snapping were 10^{-7} 10 g/1, respectively. The amounts of time spent swimming and moving the pelvic fins over the bottom were power functions of the food extract concentration. For hake, variation in one sensory input, strength of a chemical food cue, largely determined the onset and duration of food searching and feeding behavior.

81-000582 Potts, G. W. THE PREDATORY BEHAVIOUR OF *CARANX MELAMPYGUS* (PISCES) IN THE CHANNEL ENVIRONMENT OF ALDABRA ATOLL (INDIAN OCEAN). *J. Zool. (Lond.)* 192(3):323-350. Nov. 1980. SFA 26(1)
[Mar. Biol. Assoc. U.K., Citadel Hill, Plymouth, England]

81-000583 Pycha, R. L. CHANGES IN MORTALITY OF LAKE TROUT (*SALVELINUS NAMAYCUSH*) IN MICHIGAN WATERS OF LAKE SUPERIOR IN RELATION TO SEA LAMPREY (*PETROMYZON MARINUS*) PREDATION, 1968-78. *Can. J. Fish. Aquatic Sci.* 37(11):2063-2073. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Ashland Biol. Stn., Ashland, WI 54806]

81-000584 Rankin, D. P. and H. J. Ashton. CRUSTACEAN ZOOPLANKTON ABUNDANCE AND SPECIES COMPOSITION IN 13 SOCKEYE SALMON (*ONCORHYNCHUS NERKA*) NURSERY LAKES IN BRITISH COLUMBIA. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 957. iv + 39p. July 1980. In English with French summ. SFA 26(1)
[Dep. Fish. Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Thirteen lakes that support juvenile sockeye salmon (*Oncorhynchus nerka*), were sampled in 1978 to determine zooplankton abundance and species composition. Average zooplankton biomass (dry wt) ranged from 2.1 mg/m^3 (Kitlope Lake) to 82.7 mg/m^3 (Stephens Lake). The lakes were divided into two groups: group I (6 lakes) having an average zooplankton biomass greater than 20 mg/m^3 and group II (7 lakes) less than 20 mg/m^3. This grouping is correlated with elevation, mean depth, precipitation and total dissolved solids. Twenty-six zooplankton species were observed. *Bosmina longispina* and *Cyclops scutifer* were the most ubiquitous and abundant zooplankters. Seasonal abundance data are reported for four lakes (Kitlope, Lowe, Alastair, and Bear lakes) and the influence of some morphometric and biological characteristics of each lake (depth, elevation, primary production,and limnetic fish densities) on zooplankton abundance and species composition are discussed.

81-000585 Roffe, T. J. POPULATION, FOOD HABITS, AND BEHAVIOR OF PINNIPEDS IN THE ROGUE RIVER AND THEIR RELATIONSHIP TO SALMONID RUNS. *Ph.D. dissertation, Oreg. State Univ.* 173p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(6):2048. Dec. 1980. SFA 26(1)

81-000586 Sarker, A. L.; N. K. Al-Daham and M. N. Bhatti. FOOD HABITS OF THE MUDSKIPPER, *PSEUDAPOCRYPTES DENTATUS* (VAL.). *J. Fish Biol.* 17(6):635-639. Dec. 1980. SFA 26(1)
[Dep. Fish. Mar. Resour., Coll. Agric., Univ. Basrah, Basrah, Iraq] The food habits of the mudskipper, *Pseudapocryptes dentatus* (Val.) ranging from 43 to 205 mm in total length collected from the mudflats at FAO estuary, Iraq were studied. A combination of numerical, frequency occurence and gravimetric methods was used to analyse the stomach contents, both qualitatively and quantitatively. The fish was found to be a strict herbivore and a frequent feeder. It fed solely on phytoplankton dominated by benthic forms. Diatoms were the most important food item in respect of both numerical and frequency occurrence methods comprising about 84% of the total number of phytoplankton organisms. The types of phytoplankton that contributed significantly to the diet were, in decreasing order of importance, *Pleurosigma, Navicula, Nitzchia, Synedra, Closteriopsis* and

FOODS/FEEDING (CONTINUED)

81-000586 CONTINUED *Oscillatoria*. Larger fish had consumed lesser amount of food, and there was usually a gradual decrease in consumption with increase in size. The mudskipper consumed food ranging from 1·3 to 10·5% of its body weight.

81-000587 Schemmel, C. STUDIES ON THE GENETICS OF FEEDING BEHAVIOUR IN THE CAVE FISH *ASTYANAX MEXICANUS* F. *ANOPTICHTHYS*. AN EXAMPLE OF APPARENT MONOFACTORIAL INHERITANCE BY POLYGENES. *J. Comp. Ethol.* 53(1):9-22. 1980. SFA 26(1)

[Zool. Inst., Univ. Hamburg, West Germany] The Mexican characid *Astyanax mexicanus* gave rise to a series of cavernicolous populations ("*Anoptichthys*") not earlier than during the Pleistocene age. When searching for food the blind cave fish swims at an angle of about 45° to the ground. The river fish, however, when having no visual information, stands vertically on its head. With the aid of infrared-videorecording and on the basis of crossing experiments it could be demonstrated that this difference in feeding behaviour is controlled by polygenes, although frequency distributions of the crossings suggest an apparent monofactorial inheritance. The evolutionary processes of adaptive reduction of headstanding and of progressive development of the gustatory equipment are genetically independent and both traits have been achieved by small genetics steps.

81-000588 Smith, J. E. SEASONALITY, SPATIAL DISPERSION PATTERNS AND MIGRATION OF BENTHIC INVERTEBRATES IN AN INTERTIDAL MARSH-SANDFLAT SYSTEM OF PUGET SOUND, WASHINGTON, AND THEIR RELATION TO WATERFOWL FORAGING AND THE FEEDING ECOLOGY OF STAGHORN SCULPIN, *LEPTOCOTTUS ARMATUS*. *Ph.D. dissertation, Univ. Wash.* 189p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1634. Nov. 1980. SFA 26(1)

81-000589 Spangler, G. R.; D. S. Robson and H. A. Regier. ESTIMATES OF LAMPREY-INDUCED MORTALITY IN WHITEFISH, *COREGONUS CLUPEAFORMIS*. *Can. J. Fish. Aquatic Sci.* 37(11):2146-2150. Nov. 1980. In English with French summ. SFA 26(1)

[Dep. Entomol. Fish Wildl., Univ. Minn., St. Paul 55108]

81-000590 Stenson, J. A. E. PREDATOR-PREY RELATIONS BETWEEN FISH AND INVERTEBRATE PREY IN SOME FOREST LAKES. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 166-183. 1979. SFA 26(1)

[Univ. Göteborg, Dep. Zool., Box 25059, S-400 31 Göteborg, Sweden] The feeding habits of two types of fish populations, with differences in species composition and density, were examined. Perch and roach utilized crustacean zooplankton to a significantly higher degree and during a longer period than the salmonids. Only larger species occurred in the salmonid stomachs. Copepoda and littoral Cladocera were more frequent in the perch stomachs than in the roach. Roach stomachs contained significantly small *Bosmina* spp. than the perch stomachs, when fish of the same size were compared. Ostracods were found only in the roach stomachs. Roach search more than perch in and on the bottom sediment as seen by the greater importance of Chironomidae larvae, Ceratopogonidae larvae and *Pisidium* spp. in the roach stomachs. The larger number of *Asellus aquaticus*, Trichoptera and Odonata species, the higher frequence of emerging specimens and the regularly presence of aquatic Hemiptera and Coleoptera in the salmonid diet, when compared to the perch and roach diet, indicate a predatory influence on the spatial distribution and abundance of these groups. This predatory influence is also revealed in bottom samples, where *Asellus* and dragon fly nymphs are common in the salmonid lakes where the lowest predation pressure from fish prevails. The selection for invertebrate predators (e.g. dragon fly nymphs) may change the balance and numeric relations between predators and prey in the benthic community.

FOODS/FEEDING (CONTINUED)

81-000591 Stobbs, R. E. FEEDING HABITS OF THE GIANT CLINGFISH *CHORISOCHISMUS DENTEX* (PISCES: GOBIESOCIDAE). *S. Afr. J. Zool.* 15(3):146-149. 1980. In English with Afrikaans summ. SFA 26(1)
[J.L.B. Smith Inst. Ichthyol., Rhodes Univ., Grahamstown, South Africa]

81-000592 Stoner, A. W. FEEDING ECOLOGY OF *LAGODON RHOMBOIDES* (PISCES: SPARIDAE): VARIATION AND FUNCTIONAL RESPONSES. *NOAA Fish Bull.* 78(2):337-352. Apr. 1980. SFA 26(1)
[Harbor Branch Inst., Inc., R.R. 1, Box 196-A, Fort Pierce, FL 33450] Five major ontogenetic stages were found in the diet of pinfish, *Lagodon rhomboides*, from Apalachee Bay, Florida, but diet and dietary breadth showed high degrees of variation with space (both local and geographic), and seasonal variation within size classes was often as dramatic as ontogenetic variation. *Lagodon rhomboides* demonstrated planktivory, omnivory, strict carnivory, and strict herbivory at different times, places, and development stages. Ontogenetic pattern in food habits was primarily a function of mouth size and changing dentition of the predator. Until it reaches 35 mm standard length, the pinfish is a obligate carnivore. Spatial and temporal variation in the food habits of pinfish was a complex function of absolute and relative abundances of food items in the field. Changes in plant consumption by fish larger than 35 mm standard length may be due to changing plant abundance or protection of prey species by macrophyte cover at a given station. Since seagrass biomass and the functional role of a single predator vary over both space and time, plant-animal and predator-prey relationships change continually; however, the life history of *L. rhomboides* is well adapted to seasonal patterns of productivity in food organisms. Multi-dimensional variation in diets rendered the trophic level concept inoperational. It is concluded that food webs are static neither in time nor in space and that taxonomic species may not be functional components in models of energetic pathways and predator-prey relationships.

81-000593 Sumida, B. Y. and H. G. Moser. FOOD AND FEEDING OF PACIFIC HAKE LARVAE, *MERLUCCIUS PRODUCTUS*, OFF SOUTHERN CALIFORNIA AND NORTHERN BAJA CALIFORNIA. *Calif. Coop. Oceanic Fish. Invest.* 21:161-166. July 1980. SFA 26(1)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038] The diet of larval Pacific hake, *Merluccius productus*, consisted primarily of copepod eggs and calanoid copepod adults, copepodites, and nauplii, based on an examination of material collected in March 1975 off southern California and northern Baja California. In spite of a large mouth, Pacific hake larvae ingested a broad size range of prey, with a concentration of food particles 70-200 µm in width. First-feeding Pacific hake larvae feed upon a wide range of prey (50 to about 400 µm prey width), and the range in prey sized changed little with larval length from 3.0-10.7 mm. Although copepod eggs, nauplii, and copepodites were a significant portion of the diet in numbers of prey, adult copepods contributed about 74% of prey volume. Observations of feeding incidence in relation to time of capture revealed a slow rate of gut evacuation. Larvae began feeding at about 1000 hours, and the number of prey items found in the gut increased during the day, reached a maximum after sunset, and thereafter decreased gradually. The comparatively large mouth, slow evacuation rate, and ability to feed on copepod stages from egg to adult seem to form an adaptive strategy for success in the relatively deep and cold strata inhabited by pacific hake larvae.

81-000594 Timmons, T. J.; W. L. Shelton and W. D. Davies. FOOD OF LARGEMOUTH BASS BEFORE AND DURING THE FIRST THREE YEARS AFTER IMPOUNDMENT OF WEST POINT RESERVOIR, ALABAMA AND GEORGIA. *J. Tenn. Acad. Sci.* 56(1):23-27. Jan. 1981. SFA 26(1)
[Auburn Univ., Auburn, AL 36830] Food of adult largemouth bass, *Micropterus salmoides*, changed from primarily crayfish to primarily fish after impoundment of West Point Reservoir. Adults in the reservoir fed predominantly on gizzard shad, *Dorosoma cepedianum*, and secondly on sunfishes (Centrarchidae). The abundance of bluegills, *Lepomis*

FOODS/FEEDING (CONTINUED)

81-000594 CONTINUED *macrochirus*, increased progressively in the reservoir, and also in the bass diet, during the first three years of impoundment. A few bass as small as 25 mm ate larval fishes, but crustaceans and insects were the major food items. Bass longer than 75 mm stopped feeding on crustaceans and ate larger insects and small fishes. Sunfishes were important prey until the bass began to feed on gizzard shad.

81-000595 Toole, C. L. INTERTIDAL RECRUITMENT AND FEEDING IN RELATION TO OPTIMAL UTILIZATION OF NURSERY AREAS BY JUVENILE ENGLISH SOLE (*PAROPHRYS VETULUS*: PLEURONECTIDAE). *Environ. Biol. Fishes* 5(4):383-390. 8 Dec. 1980. SFA 26(1)
[Ecological Analysts, Inc., 2150 John Glenn Dr., Concord, CA 94520]

81-000596 Van Den Avyle, M. J. and J. R. Wilson. FOOD HABITS AND FEEDING SELECTIVITY OF LARVAL *DOROSOMA* SPP. IN CENTER HILL RESERVOIR. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 146-156. Sept. 1980. SFA 26(1)
[Tenn. Coop. Fish. Res. Unit, Tenn. Technol. Univ., Cookeville 38501] Food habits and feeding selectivity of larval shad in Center Hill Reservoir were studied from May through July 1978. Copepods, cladocerans, and rotifers contributed at least 80% of the diet during each month. Major food items were *Keratella*, *Trichocerca*, *Bosmina*, and copepod nauplii, but electivity indices showed that *Diaphanosoma* and *Trichocerca* were selected for during all months while *Diaptomus* and *Polyarthra* were consistently selected against. Temporal variations of food habits and selectivity were attributed to increased length of larvae rather than changes in abundance of prey organisms. Copepod nauplii were selected for in May; *Cyclops*, *Bosmina*, and *Daphnia* were preferred in June; and *Bosmina* and *Trichocerca* were selected for in July.

81-000597 Van Den Avyle, M. J. and J. E. Rousell. EVALUATION OF A SIMPLE METHOD FOR REMOVING FOOD ITEMS FROM LIVE BLACK BASS. *Prog. Fish-Cult.* 42(4):222-223. Oct. 1980. SFA 26(1)
[Tenn. Coop. Fish. Res. Unit, Tenn. Technol. Univ., Cookeville 38501]

81-000598 Weisberg, S. B. and V. A. Lotrich. FOOD LIMITATION OF THE MUMMICHOG, *FUNDULUS HETEROCLITUS*, IN A DELAWARE SALT MARSH. *Am. Zool.* 20(4):880. 1980. Abstract only. SFA 26(1)
[Univ. Del., Newark] Food availability for the mummichog, *Fundulus heteroclitus*, was examined using caging techniques. Cages 8 m x 20 m were stocked with fish at densities ranging from 1/8 to four times normal density. Fish kept at the low density grew more than twice as fast as fish kept at normal density. At four times normal density negative growth was observed and egg production ceased. Addition of food in the subtidal portion of the habitat produced a positive effect on growth rate. Food added on the marsh surface, an area available to this fish only during high tides, failed to produce a similar effect. *Fundulus heteroclitus* appears to be food limited in its natural habitat despite the fact that an abundant food resource exists on the marsh surface, where tidally influenced time limitation prevents its foraging for extended periods.

81-000599 Wells, L. LAKE TROUT (*SALVELINUS NAMAYCUSH*) AND SEA LAMPREY (*PETROMYZON MARINUS*) POPULATIONS IN LAKE MICHIGAN, 1971-78. *Can. J. Fish. Aquatic Sci.* 37(11):2047-2051. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Great Lakes Fish. Lab., Ann Arbor, MI 48105]

FOODS/FEEDING (CONTINUED)

81-000600 Wilhelm. W. THE DISPUTED FEEDING BEHAVIOUR OF A PAEDOPHAGOUS HAPLOCHROMINE CICHLID (PISCES) OBSERVED AND DISCUSSED. *Behaviour* 74(3-4):310-323. 1980. In English with French summ. SFA 26(1)
[c/o C.D.N. Barel, Zool. Lab., P.O. Box 9516, 2300 RA Leiden, The Netherlands]

81-000601 Williams, J. E. and C. D. Williams. FEEDING ECOLOGY OF *GILA BORAXOBIUS* (OSTEICHTHYES: CYPRINIDAE) ENDEMIC TO A THERMAL LAKE IN SOUTHEASTERN OREGON. *Great Basin Nat.* 40(2):101-114. 30 June 1980. SFA 26(1)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331] *Gila boraxobius* is a dwarf species of cyprinid endemic to a thermal lake in southeastern Oregon. Despite a relatively depauperate fauna and flora in the lake, 24 food items were found in intestines of *G. boraxobius*. Ten of the 24 foods, including six insects, were of terrestrial origin. The relative importance of food items fluctuated seasonally. Diatoms, chironomid larvae, microcrustaceans, and dipteran adults were the primary foods during spring. In summer, diatoms decreased and terrestrial insects increased in importance. During autumn important foods were terrestrial insects, chironomid larvae, and diatoms. Diatoms and microcrustaceans increased in importance during winter. Chironomid larvae were of importance in winter, when the importance of terrestrial food items decreased substantially. Similar food habits were observed between juveniles and adults, except that adults consumed more gastropods and diatoms and juveniles consumed more copepods and terrestrial insects. *Gila boraxobius* feeds opportunistically with individuals commonly containing mostly one food item. Fish typically feed by picking foods from soft bottom sediments or from rocks. However, fish will feed throughout the water column or on the surface if food is abundant there. *Gila boraxobius* feeds throughout the day, with a peak in feed activity just after sunset. A daily ration of 11.1 percent body weight was calculated for the species during June. A comparison of food habits among *G. boraxobius* and populations of *G. alvordensis* during the summer shows that all are opportunistic in feeding, but that *G. boraxobius* relies more heavily on terrestrial foods.

81-000602 Youngs, W. D. ESTIMATE OF LAMPREY-INDUCED MORTALITY IN A LAKE TROUT (*SALVELINUS NAMAYCUSH*) POPULATION. *Can. J. Fish. Aquatic Sci.* 37(11):2151-2158. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Nat. Resour., N.Y. State Coll. Agric. Life Sci., Cornell Univ., Ithaca 14853]

81-000603 Zubenko, Ye. B. THE SEASONAL DYNAMICS OF FEEDING OF THE PERCH, *PERCA FLUVIATILIS*, FROM KREMENCHUG RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):64-70. 1979. SFA 26(1)
[Inst. Hydrobiol., Ukrainian SSR Acad. Sci., Kiev, USSR]

AGE AND GROWTH

81-000604 Bayer, R. D. SIZE AND AGE OF THE TUBE-SNOUT (*AULORHYNCHUS FLAVIDUS*) IN THE YAQUINA ESTUARY, OREGON. *Northwest Sci.* 54(4):306-310. Nov. 1980. SFA 26(1)
[423 S.W. 9th, Newport, OR 97365]

81-000605 Bergot, P.; J. M. Blanc and A. M. Escaffre. RELATIONSHIP BETWEEN NUMBER OF PYLORIC CAECA AND GROWTH IN RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON). *Aquaculture* 22(1-2):81-96. Jan. 1981. SFA 26(1)

AGE AND GROWTH (CONTINUED)

81-000605 CONTINUED
[Lab. Nutr. Poissons, I.N.R.A., St. Pée sur Nivelle, 64310 Ascain, France] The relationship between fish length and number of pyloric caeca was studied in fullsib families, with different caeca number, which were obtained through genetic selection and reared in two different hatcheries. At Lees-Athas hatchery a significant positive correlation between caeca number and size of fish of the same age was demonstrated, both within and between families. An influence of rearing conditions upon this relationship was also observed as no significant correlation was found in Donzacq hatchery with the same families. In both hatcheries, families with many caeca exhibited better food conversion ratios than families with fewer caeca, the former showing either lower feed intake for the same growth rate or greater weight gain for the same feed intake. Two non-exclusive hypotheses could account for the growth-caeca number relationship: the caeca number could be either an indictive character reflecting initial growing conditions or a casual character, acting on intestinal morphology and food utilization. In either case, caeca number seems to be an interesting criterion in trout selection.

81-000606 Boehlert, G. W. SIZE COMPOSITION, AGE COMPOSITION, AND GROWTH OF CANARY ROCKFISH, *SEBASTES PINNIGER*, AND SPLITNOSE ROCKFISH, *S. DIPLOPROA*, *FROM THE 1977 ROCKFISH SURVEY*. *Mar. Fish. Rev.* 42(3-4):57-63. Mar.-Apr. 1980. SFA 26(1)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331] Trawl samples from California to Washington (Lat. 34°00'-48°30'N) taken in the 1977 Rockfish Survey were analyzed to provide information on growth, size composition, and age composition of canary rockfish, *Sebastes pinniger*, and splitnose rockfish, *S. diploproa*. Canary rockfish were taken predominantly in the Oregon-Washington region at depths of 50-149 fathoms (91-272 m). This species was considered as a single stock; recruitment to the sampling gear and area was complete at ages of approximately 14-15 years and sizes of 51 cm (males) and 55 cm (females). Splitnose rockfish were taken in all areas, at depths of 50-260 fathoms (91-475 m); it was considered in three latitudinal strata (based on differences in growth) and two depth strata (based on differences in length-frequencies). Recruitment to the sampling gear and area was generally complete at ages 14-17 and sizes of 26 cm (males) and 29 cm (females). Fish in shallow strata were smaller than in the deep strata. In the deep strata there was a general trend of increasing mean size to the north. The size and age compositions in the northern stratum, when compared with historical data, suggest and impact of fishing pressure. It is suggested that the close ecological associationof splitnose rockfish with Pacific ocean perch, *S. alutus*, may have resulted in a concomitant decline in stocks due to incidental catches of the former.

81-000607 Casselman, J. M. THE ESOCID CLEITHRUM AS AN INDICATOR CALCIFIED STRUCTURE. *Proc. Warm Water Workshop Northeast Div. Am. Fish Soc.* 10:249-272. 1977(1979). SFA 26(1)
[Ontario Minist. Nat. Resour., Fish Br., Res. Sect., Box 50, Maple, ON L0J 1E0, Canada]

81-000608 Colle, D. E. and J. V. Shireman. COEFFICIENTS OF CONDITION FOR LARGEMOUTH BASS, BLUEGILL, AND REDEAR SUNFISH IN HYDRILLA-INFESTED LAKES. *Trans. Am. Fish. Soc.* 109(5):521-531. Sept. 1980. SFA 26(1)
[Aquatic Plant Res. Cent., Sch. For. Resour. Conserv., Univ. Fla., Gainesville 32611]

81-000609 Dadzie, S. and B. C. C. Wangila. REPRODUCTIVE BIOLOGY, LENGTH-WEIGHT RELATIONSHIP AND RELATIVE CONDITION OF POND RAISED *TILAPIA ZILLI* (GERVAIS). *J. Fish Biol.* 17(3):243-253. Sept. 1980. SFA 26(1)

AGE AND GROWTH (CONTINUED)

81-000609 CONTINUED
[FAO African Reg. Aquacult. Cent., P.M.B. 6165, Port Harcourt, Nigeria] In 'runted' populations of *Tilapia zilli* positive correlations were found between maturation stages and the following: gonadosomatic index, gonad weight, fish weight and fish length. The minimum size at maturity was 9.0 cm in males and 11.0 cm in females. The mean fecundity in the 'stunted' females was 2359 eggs and it increased with length (L) weight (W) and depth (D) of the fish. There was, however, no correlation between fucundity and egg size. The results indicated that growth in this 'stunted' *T. zilli* population was not isometric. The relative condition factor (*Kn*) which approached one indicates good condition.

81-000610 Donald, D. B.; R. S. Anderson and D. W. Mayhood. CORRELATIONS BETWEEN BROOK TROUT GROWTH AND ENVIRONMENTAL VARIABLES FOR MOUNTAIN LAKES IN ALBERTA. *Trans. Am. Fish. Soc.* 109(6):603-610. Nov. 1980. SFA 26(1)
[Can. Wildl. Serv., 1000, 992-108 St., Edmonton, AB T5K 2J5, Canada]

81-000611 Duncan, K. W. ON THE BACK-CALCULATION OF FISH LENGTHS; MODIFICATIONS AND EXTENSIONS TO THE FRASER-LEE EQUATION. *J. Fish Biol.* 16(6):725-730. June 1980. SFA 26(1)
[Dep. Zool., Univ. Canterbury, P.B. Christchurch, New Zealand] The basis of the widely used Fraser-Lee equation for back-calculating lengths is discussed and a new algebraic method of calculating the constant is given. This algebraic method gave satisfactory results for the back-calculation of European perch (*Perca fluviatilis* L.) lengths in Lake Mahinerangi, New Zealand. Errors in back-calculation are much higher than regression techniques would suggest. Causes of the Rosa Lee phenomenon are discussed and methods are given for detecting it and compensating for it using a computer program, BACKCALC.

81-000612 Fedorova, G. V. THE VIMBA OF LAKE LADOGA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):41-45. 1979. SFA 26(1)
[GosNIORKH, Leningrad, USSR]

81-000613 Fischer, M. SIZE DISTRIBUTION, LENGTH-WEIGHT RELATIONSHIPS, SEX RATIOS, AND SEASONAL OCCURRENCE OF KING MACKEREL (*SCOMBEROMORUS CAVALLA*) OFF THE SOUTHEAST LOUISIANA COAST. *La. Wildl. Fish. Comm. Tech. Bull.* No. 31. 1-21. Aug. 1980. SFA 26(1)
[La. Mar. Res. Lab., Grand Terre Island]

81-000614 Fraidenburg, M. E. YELLOWTAIL ROCKFISH, *SEBASTES FLAVIDUS*, LENGTH AND AGE COMPOSITION OFF CALIFORNIA, OREGON, AND WASHINGTON IN 1977. *Mar. Fish. Rev.* 42(3-4):54-56. Mar.-Apr. 1980. SFA 26(1)
[Wash. State Dep. Fish., 115 Gen. Admin. Bldg., Olympia 98504] Yellowtail rockfish, *Sebastes flavidus*, length and age samples from a 1977 survey of rockfishes off California, Oregon, and Washington were analyzed to produce length and age composition data for the area from lat. 35°30' to 48°30'N. There was evidence of a north to south cline of decreasing size and age. Length composition data showed strong single modes for males and many modes over a broader size range for females. Age composition data showed two prominent modes at 8-10 and 13-14 years old. No major differences in the age-length relationship were noted between areas using data from the survey and data from market samples from Washington's trawl fishery. Data for all areas were pooled to fit a common growth curve for the northern California to Queen Charlotte Sound, British Columbia, region.

81-000615 Gasser, K. W. and D. W. Johnson. BARKLEY LAKE SYMPOSIUM. GROWTH VARIATION IN SELECTED FISHES OF BARKLEY LAKE AND ADJOINING LAND BETWEEN THE LAKES SUBIMPOUNMENTS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl.*

AGE AND GROWTH (CONTINUED)

81-000615 CONTINUED *Agencies* 33:723-737. 1979(1980). SFA 26(1)
[Hancock Biol. Stn., Murray State Univ., Murray, KY 42071] Population growth differences were demonstrated for channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*) and freshwater drum (*Aplodinotus grunniens*) from mainstream bays of Barkley Lake, as well as between these bays and adjoining subimpoundments. Growth in Crooked Creek Bay fish was atypical, with those fish exhibiting overall superior growth. Subimpoundments contained viable fish populations, but those fish were generally in poorer condition than mainstream fish. Great heterogeneity in growth existed within a large flood control reservoir.

81-000616 Hein, S.; C. Dugas and J. Shepard. TOTAL LENGTH-STANDARD AND LENGTH-WEIGHT REGRESSIONS FOR SPOTTED SEATROUT, *CYNOSCION NEBULOSUS*; RED DRUM, *SCIAENOPS OCELLATA*; and BLACK DRUM, *POGONIAS CROMIS*, IN SOUTH-CENTRAL LOUISIANA. *La. Wildl. Fish. Comm. Tech. Bull.* No. 31. p. 41-54. Aug. 1980. SFA 26(1)
[La. Mar. Res. Lab., Grand Terre Island] Standard length (SL) - total length (TL) relationships for three commercially important sciaenids were found to be SL = -3.8832 + 0.8653 TL for spotted seatrout; SL = -2.0520 + 0.8369 TL for red drum; and SL = 0.8331 TL - 8.6854 for black drum. Length-weight relationships were also computed and found to be Log W = -5.4215 + 3.1542 TL for spotted seatrout; Log W = -5.1197 + 3.0523 Log TL for red drum; and Log W = 2.9709 Log TL - 4.8176 for black drum.

81-000617 Hesthagen, T. GROWTH AND YIELD OF AN ALPINE POPULATION OF BROWN TROUT, *SALMO TRUTTA* L., IN EASTERN NORWAY. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 34-40. 1979. SFA 26(1)
[Dir. Wildl. Freshwater Fish, N-7000, Trondheim, Norway]

81-000618 Hoag, S. H.; G. H. Williams; R. J. Myhre and I. R. McGregor. HALIBUT ASSESSMENT DATA: SETLINE SURVEYS IN THE NORTH PACIFIC OCEAN, 1963-1966 and 1976-1979. *Int. Pac. Halibut Comm. Tech. Rep.* No. 18. 43p. 1980. Available from Int. Pac. Halibut Comm., P.O. Box 5009, University Station, Seattle, WA 98105]

81-000619 Kanno, Y. [ON THE LIFE HISTORY OF HERRING, *CLUPEA PALLASII* CUVIER ET VALENCIENNES, IN THE BRACKISH LAKE NOTORO, HOKKAIDO. II. THE RELATIONSHIP BETWEEN LAND-LOCKED AND MIGRATORY HERRING BASED ON SCALE ANALYSIS.] *Bull. Fac. Fish. Hokkaido Univ.* 31(2):175-183. June 1980. In Japanese with English summ. SFA 26(1)
[Lab. Biol. Fish Popul., Fac. Fish., Hokkaido Univ., Minato-cho, Hakodate 041, Japan]

81-000620 Kinoshita, T. [FITTING EQUATIONS TO THE GROWTH CURVE FOR THE FIRST YEAR OF LIFE OF THE JAPANESE ANCHOVY, *ENGRAULIS JAPONICA*, CAUGHT IN THE TSUGARU STRAIT.] *Bull. Fac. Fish. Hokkaido Univ.* 31(2):149-160. June 1980. In Japanese with English summ. SFA 26(1)
[Lab. Biol. Fish Popul., Fac. Fish., Hokkaido Univ., Minato-cho, Hakodate 041, Japan]

81-000621 Padrón, F. G.; A. P. Martínez; M. Prokeš and J. Libosvárský. OBSERVATION ON LENGHTS, SEX, GROWTH AND AGE OF LARGEMOUTH BASS FROM LAGUNA DEL TESORO (CUBA). *Acta Sci. Nat. Brno* 14(4):25-36. 1980. SFA 26(1)
[Dep. Ecol., Inst. Zool., Acad. Ciencias Cuba, Rpto. Atabey, Playa, Havana, Cuba]

AGE AND GROWTH (CONTINUED)

81-000622 Shelbourn, J. E. and W. C. Clarke. SALINITY, TEMPERATURE AND PHOTOPERIOD EFFECTS ON GROWTH OF COHO SALMON FRY. *Am. Zool.* 20(4):907. 1980. Abstract only. SFA 26(1)

[Pac. Biol. Stn., Nanaimo, BC, Canada] The experiment was designed to examine the influence of temperature, salinity and photoperiod on growth rate. Temperatures ranged from 8 to 18°C and salinities from fresh water to 20°/oo. Simulated natural photoperiod was compared with three artificial photopriods in order to test techniques for accelerating growth. Coho fry were raised in 197 litre culture tanks for 20 weeks from an itial weight of 0.4 g. At regular intervals, all the fish in each tank were anesthetized, weighed individually and replaced in the tank. Growth was reduced somewhat at 20°/oo, particularly at 8°C. The artificial photoperiods suppressed growth in comparison with natural photoperiod, the effects being more apparent at 15°C. Under natural photoperiod, the greatest weight was attained at 17°C in fresh water.

81-000623 Thoresson, G. THE BODY/SCALE RELATIONSHIP IN ROACH, *RUTILUS RUTILUS* (L.), FROM A BALTIC ARCHIPELAGO. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 184-192. 1979. SFA 26(1)

[Res. Lab., Natl. Swedish Environ. Prot. Bd., S-740 71 Öregrund, Sweden] The body scale relationship in roach from a Baltic archipelago was investigated for 1,100 females arranged in length groups with a class width of 20 mm extending from 40 mm to 260 mm (total lengths), 100 in each group. Six scales were measured from each fish. A sample of 130 small fishes, 30-63 mm, was studied separetely. A very good fit was achieved when introducing means of the six scales from each individual into the formula: $\ln Y = \ln 65.84 + 0.8244 \ln X$. On the basis of this equation body lengths may be back-calculated as follows: $L = L_s (r/R)^b$ where L= back-calculated body length, L_s=final length, r= intermediate scale radius, R=total scale radius and b=0.8244.

81-000624 Thorpe, J. E. and R. I. G. Morgan. GROWTH-RATE AND SMOLTING-RATE OF PROGENY OF MALE ATLANTIC SALMON PARR, *SALMO SALAR* L. *J. Fish Biol.* 17(4):451-459. Oct. 1980. SFA 26(1)

[Freshwater Fish. Lab., Pitlochry, Perthshire PH16 5LB, Scotland]

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[Freshwater Fish. Lab., Pitlochry PH16 5LB, Scotland] Development of bimodality in the length frequency distributions of sibling juvenile Atlantic salmon, *Salmo salar* L., was observed in three experiments, using eight families in 25 tank populations. Divergence between the groups became evident in late summer or early autumn. The time of divergence, and the size of fish at which this change took place differed between families.

81-000626 Timmons, T. J. and R. D. Estes. AGE AND GROWTH OF BLUEGILLS IN NICKAJACK RESERVOIR, TENNESSEE. *J. Tenn. Acad. Sci* 55(4):137-138. Oct. 1980. SFA 26(1)

[Tenn. Tech Univ., Cookeville 38501]

81-000627 Vasil'kov, V. P. THE SIGNIFICANCE, NATURE AND POSSIBLE CAUSES OF GROWTH RHYTHM IN FISH. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):56-63. 1979. SFA 26(1)

[TINRO, Vladivostok, USSR] Methods of photometric evaluation of sclerite series of fish scales and mathematical spectral analysis of measurements has made it possible to obtain quantitative information on the growth rhythms of some species from the Pacific Ocean. The structure of the rhythms is explained and an evaluation made of their variance as related to changes in the rate of growth. The nature and character of the rhythms established are to some extent elucidated.

AGE AND GROWTH (CONTINUED)

81-000628 Wilkins, M. E. SIZE COMPOSITION, AGE COMPOSITION, AND GROWTH OF CHILIPEPPER, *SEBASTES GOODEI*, AND BOCACCIO, *S. PAUCISPINIS*, FROM THE 1977 ROCKFISH SURVEY. *Mar. Fish. Rev.* 42(3-4):48-53. Mar.-Apr. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

81-000629 Wilson, K. H. and P. A. Larkin. DAILY GROWTH RINGS IN THE OTOLITHS OF JUVENILE SOCKEYE SALMON (*ONCORHYNCHUS NERKA*). *Can. J. Fish. Aquatic Sci.* 37(10):1495-1498. Oct. 1980. In English with French summ. SFA 26(1)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

81-000630 Yoshida, H. and H. Kato. [THE RELATIONSHIP BETWEEN THE SUBOPERCLE SIZE AND BODY LENGTH OF WALLEYE POLLOCK, *THERAGRA CHALCOGRAMMA* (PALLAS).] *Bull. Fac. Fish. Hokkaido Univ.* 31(2):169-174. June 1980. In Japanese with English summ. SFA 26(1)
[Res. Inst. North Pac. Fish., Fac. Fish., Hokkaido Univ., Minato-cho, Hakodate 041, Japan]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

81-000631 Adams, P. B. MORPHOLOGY AND DISTRIBUTION PATTERNS OF SEVERAL IMPORTANT SPECIES OF ROCKFISH (GENUS *SEBASTES*). *Mar. Fish. Rev.* 42(3-4):80-82. Mar.-Apr. 1980. SFA 26(1)
[NMFS, 3150 Paradise Dr., Tiburon, CA 94920] This paper investigates some aspects of the relationship between morphology and distribution of some of the commercially important species of rockfish (genus *Sebastes*). On the basis of morphometrics, several species pairs of rockfish are suggested. Members of the species pairs are found to be spatially segregated. It is suggested that certain types of adaptive strategies are very important in terms of species that can support commercial fisheries.

81-000632 Armantrout, N. B. THE FRESHWATER FISHES OF IRAN. *Ph.D. dissertation, Oreg. State Univ.* 1980. From Diss. Abstr. Int. B Sci. Eng. 41(6):1996. Dec. 1980. SFA 26(1)

81-000633 Bailey, K. M. RECENT CHANGES IN THE DISTRIBUTION OF HAKE LARVAE: CAUSES AND CONSEQUENCES. *Calif. Coop. Oceanic Fish. Invest.* 21:167-171. July 1980. SFA 26(1)
[Coll. Fish., Univ. Wash., Seattle 98195]

81-000634 Bardack, D. and S. Teller-Marshall. *TSELFATIA*, A TETHYAN CRETACEOUS TELEOST: FIRST RECORDS FROM NORTH AMERICA AND YUGOSLAVIA. *J. Paleontol.* 54(5):1075-1083. Sept. 1980. SFA 26(1)
[Dep. Biol. Sci., Univ. Ill., Chicago Circle, Chicago 60680]

81-000635 Behnke, R. J. and D. E. Benson. ENDANGERED AND THREATENED FISHES OF THE UPPER COLORADO RIVER BASIN. *Colo. State Univ. Coop. Ext. Serv. Bull.* 503A. 34p. Sept. 1980. Available at no cost from Ext. Serv. Bull. Room, 171

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

81-000635 CONTINUED Aylesworth Hall, CSU, Fort Collins, CO 80523. SFA 26(1)
[Fish. Wildl. Biol., 0015 J.V.K. Wagar Bldg., CSU, Fort Collins, CO 80523] Discusses the biology, distribution, current status and reasons for decline of five species native to the upper Colorado River basin: Colorado River squawfish, *Ptychocheilus lucius*; humpback chub, *Gila cypha*; bonytail chub, *Gila elegans*; razorback sucker, *Zyraucken texanus*; and Colorado River cutthroat trout, *Salmo clarki pleuriticus*. An interpretation of the Endangered Species Act is included.

81-000636 Brewer, G. D.; R. J. Lavenberg and G. E. McGowen. FISH REPRODUCTION IN THE NEARSHORE SOUTHERN CALIFORNIA BIGHT: AN OVERVIEW BASED ON ICHTHYOPLANKTON SURVEYS. *Am. Zool.* 20(4):836. 1980. Abstract only. SFA 26(1)
[Univ. South. Calif., Los Angeles]

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[AzCherNIRO, Kerch, USSR]

81-000638 Cadwallader, P. L.; G. N. Backhouse and R. Fallu. OCCURRENCE OF EXOTIC TROPICAL FISH IN THE COOLING PONDAGE OF A POWER STATION IN TEMPERATE SOUTH-EASTERN AUSTRALIA. *Aust. J. Mar. Freshwater Res.* 31(4):541-546. Sept. 1980. SFA 26(1)
[Fish Wildl. Div., Minist. Conserv., Snobs Creek Freshwater Fish Stn., P.B. 20, Alexandria, Victoria 3714, Australia]

81-000639 Conner, J. V.; R. P. Gallagher and M. F. Chatry. LARVAL EVIDENCE FOR NATURAL REPRODUCTION OF THE GRASS CARP (*CTENOPHARYNGODON IDELLA*) IN THE LOWER MISSISSIPPI RIVER. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 1-19. Sept. 1980. SFA 26(1)
[Sch. For. Wildl. Manage., La. State Univ., Baton Rouge 70803] Certain protolarvae and early mesolarvae found in late spring and summer ichthyoplankton samples from the lower Mississippi River, Louisiana and Arkansas, are identified as those of the exotic grass carp, *Ctenopharyngodon idella* (Valenciennes). These larvae have 41 to 44 (usually 42 or 43) myomeres which readily distinguishes them from young of most native or naturalized cypriniforms that could conceivably be in the lower mainstem Misssissippi River. Grass carp larvae are superficially similar to those of *Cyprinus carpio* and the ictiobine suckers (*Carpiodes* spp., *Ictiobus* spp.), but *Ctenopharyngodon* has 30 to 33 (usually 31-32) preanal myomeres as oppoded to 24 to 30. *Ctenopharyngdon* larvae first appeared in 1975 and became common and abundant, relative to other cypriniform young, by 1977. Our observations indicate natural spawning by grass carp somewhere upstream of Eudora, Arkansas, and thus confirms predictions of Stanley (1976) and Stanley et al. (1978), except that spawning occured three years earlier.

81-000640 Dentler, J. L. and G. D. Grossman. A GEOGRAPHIC RECORD FOR THE REDTAIL SURFPERCH, *AMPHISTICHUS RHODOTERUS*. *Calif. Fish Game* 66(4):242. Oct. 1980. SFA 26(1)
[Dep. Wildl. Fish., Oreg. State Univ., Corvallis 97331]

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81-000641 Gabriel, W. L. and A. V. Tyler. PRELIMINARY ANALYSIS OF PACIFIC COAST DEMERSAL FISH ASSEMBLAGES. *Mar. Fish. Rev.* 42(3-4):83-88. Mar.-Apr. 1980. SFA 26(1)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331] The purpose of this portion of an on-going study was to describe demersal fish assemblages on the Oregon continental shelf between the mouth of the Columbia River and Yaquina Head, based on species biomass data collected during the 1977 Rockfish Survey, and to compare these assemblages with those described from data collected in 1973 during the Oregon Department of Fish and Wildlife otter trawl survey. Statistical clustering techniques (including the Bray-Curtis index of dissimilarity and group-average clustering strategy) yielded 12 assemblages. Except for one area (Falcon Shalebeds), species dominating each assemblage were consistent between the two surveys.

81-000642 Gotshall, D. W.; G. H. Allen and R. A. Barnhart. AN ANNOTATED CHECKLIST OF FISHES FROM HUMBOLDT BAY, CALIFORNIA. *Calif. Fish Game* 66(4):220-232. Oct. 1980. SFA 26(1)
[Calif. Dep. Fish Game, P.O. Box 98, Avila Beach 93424]

81-000643 Halliwell, D. B. A LIST OF THE FRESHWATER FISHES OF MASSACHUSETTS. *Mass. Div. Fish. Wildl. Fauna Mass. Ser.* No. 4. 13p. 1979. SFA 26(1)
[Mass. Div. Fish. Wildl., Westboro]

81-000644 Hesse, L. W.; G. Zuerlein; R. Vancil; L. Koziol; B. Newcomb and L. A. Retelsdorf. NIOBRARA-MISSOURI RIVER FISHERY INVESTIGATIONS. *Nebr. Game Parks Comm. Tech. Serv.* No. 5. 39p. 1979. Available from Nebr. Game Parks Comm., P.O. Box 30370, Lincoln 68503. SFA 26(1)

81-000645 Kalinina, Ye. M. and V. A. Sebletskaya. THE QUALITATIVE COMPOSITION AND DISTRIBUTION OF ICHTHYOPLANKTON OFF THE COAST OF MAURITANIA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):146-150. 1979. SFA 26(1)
[AtlantNIRO, Kaliningrad, USSR]

81-000646 Kerbavaz, J. H. THE RECOVERY OF THE OWENS PUPFISH. *Outdoor Calif.* 41(5):6-8. Sept.-Oct. 1980. SFA 26(1)
[Calif. Dep. Fish Game, Bishop]

81-000647 Laflin, B. D. INVENTORY AND CLASSIFICATION OF STREAMS IN THE ROUGH RIVER AND NOLIN RIVER DRAINAGES. *Ky. Dep. Fish Wildl. Resour. Bull.* No. 65. 91p. Oct. 1980. SFA 26(1)

81-000648 Lambert, T. R. STATUS OF REDEYE BASS, *MICROPTERUS COOSAE*, IN THE SOUTH FORK STANISLAUS RIVER, CALIFORNIA. *Calif. Fish Game* 66(4):240-242. Oct. 1980. SFA 26(1)
[Pacific Gas Electric Co., 3400 Crow Canyon Rd, San Ramon, CA 94583]

81-000649 Lee, D. S.; C. R. Gilbert; C. H. Hocutt; R. E. Jenkins; D. E. McAllister and J. R. Stauffer, Jr. ATLAS OF NORTH AMERICAN FRESHWATER FISHES. *N.C. Biol. Surv. Publ.* 1980-12. x + 854p. 1980. Available @ $23.00 ($25.50 Canada) from N.C. State Mus. Nat. Hist., P.O. Box 27647, Raleigh 27611. SFA 26(1)

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81-000650 Legendre, V.; J.-R. Mongeau; J. Leclerc and J. Brisebois. LES SALMONIDÉS DES EAUX DE LA PLAINE DE MONTRÉAL. I. HISTORIQUE, 1534-1977. [THE SALMON OF THE PLAINE DE MONTREAL. 1. HISTORY, 1534-1977.] *Quebec Serv. Amenage. Exploit. Faune Rap. Tech.* No. 06-27. 280p. 2 Sept. 1980. In French with English summ. SFA 26(1)
[Prov. Quebec, 5075, rue Fullum, Montreal, PQ H2H 2K3, Canada]

81-000651 Lewis, D. B. STUDIES OF THE BIOLOGY OF THE LESSER WEEVER FISH, *TRACHINUS VIPERA* CUVIER II. DISTRIBUTION. *J. Fish Biol.* 17(2):127-133. Aug. 1980. SFA 26(1)
[Dep. Adult Educ., Univ. Hull, England]

81-000652 Lubbock, R. THE SHORE FISHES OF ASCENSION ISLAND. *J. Fish Biol.* 17(3):283-303. Sept. 1980. SFA 26(1)
[Dep. Zool., Univ. Cambridge, Downing St., Cambridge CB2 3EJ, England] Seventy-one species of shore fishes are recorded from Ascension in a checklist which includes notes on ecology and behaviour. The extraordinary abundance of blackfish, *Melichthys niger*, and the aggressive nature of moray eels, *Lycodontis moringa*, towards man are briefly mentioned. The number of species recorded is low for a tropical island and seems to reflect Ascension's geographical isloation and lack of habitat diversity; 15.7% of Ascension shore fishes (excluding one fish not identified to species level) appear to be endemic to the island, with a further 17.1% known only from Ascension and St. Helena; 30.0% are recorded only from the western and central Atlantic, while 7.1% are recorded from the eastern and central Atlantic; 30.0% are widespread Atlantic species. Two new species are described: *Taenioconger camelopardalis* and *Helcogramma ascensionis*.

81-000653 Marais, J. F. K. and D. Baird. SEASONAL ABUNDANCE, DISTRIBUTION AND CATCH PER UNIT EFFORT OF FISHES IN THE SWARTKOPS ESTUARY. *S. Afr. J. Zool.* 15(2):66-71. 1980. In English with Afrikaans summ. SFA 26(1)
[Dep. Zool., Univ. Port Elizabeth , P.O. Box 1600, Port Elizabeth, 6000, South Africa]

81-000654 Mearns, A. J.; M. J. Allen; M. D. Moore and M. J. Sherwood. DISTRIBUTION, ABUNDANCE, AND RECRUITMENT OF SOFT-BOTTOM ROCKFISHES (SCORPAENIDAE: *SEBASTES*) ON THE SOUTHERN CALIFORNIA MAINLAND SHELF. *Calif. Coop. Oceanic Fish. Invest.* 21:180-190. July 1980. SFA 26(1)
[NMFS, 7600 Sand Point Way NE, Seattle, WA 98115]

81-000655 Melville-Smith, R. and D. Baird. ABUNDANCE, DISTRIBUTION AND SPECIES COMPOSITION OF FISH LARVAE IN THE SWARTKOPS ESTUARY. *S. Afr. J. Zool.* 15(2):72-78. 1980. In English with Afrikaans summ. SFA 26(1)
[Sea Fish. Br., Dep. Ind., Sea Point, Cape Town 8001, South Africa]

81-000656 Mohsin, A. K. M. and A. T. Law. ENVIRONMENTAL STUDIES OF KELANG RIVER II. EFFECTS ON FISH. *Malay. Nat. J.* 33(3-4):189-199. June 1980. SFA 26(1)
[Fac. Fish. Mar. Sci., Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia.]

81-000657 Morman, R. H.; D. W. Cuddy and P. C. Rugen. FACTORS INFLUENCING THE DISTRIBUTION OF SEA LAMPREY (*PETROMYZON MARINUS*) IN THE GREAT LAKES. *Can. J. Fish. Aquatic Sci.* 37(11):1811-1826. Nov. 1980. In English with

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

81-000657 CONTINUED French summ. SFA 26(1)
[U.S. FWS, Ludington Biol. Stn., Ludington, MI 49431]

81-000658 Nicholson, J. A CHECKLIST OF FISHES FROM THE CAVALLI ISLANDS, NORTHLAND, NEW ZEALAND. *Tane* 25:133-139. 1979. SFA 26(1)
[16 Gordon Craig Place, Algies Bay, Warkworth, New Zealand]

81-000659 Orth, D. J. and R. N. Jones. RANGE EXTENSIONS OF THE ORANGETHROAT DARTER (*ETHEOSTOMA SPECTABILE*) AND THE FRECKLED MADTOM (*NOTURUS NOCTURNUS*) INTO WESTERN OKLAHOMA. *Proc. Okla. Acad. Sci.* 60:98-99. 1980. SFA 26(1)
[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater 74078]

81-000660 Pageau, G.; Y. Gravel and V. Legendre. DISTRIBUTION AND VALUE OF THE ESOCIDAE IN QUÉBEC WATERS. *Proc. Warm Water Workshop Northeast Div. Am. Fish. Soc.* 10:1-7. 1977(1979). SFA 26(1)
[Dep. Sci. Biol., Univ. Montreal, PQ, Canada]

81-000661 Pequeño R., G. and G. Revuelta. NOTACANTHIFORM FISHES OF THE CONTINENTAL SLOPE OF CHILE. *Copeia* 1980(4):892-895. 5 Dec. 1980. SFA 26(1)
[Inst. Zool., Univ. Austral de Chile, Casella 567, Valdivia, Chile]

81-000662 Prut'ko, V. G. ON THE OCCURRENCE OF THE OPAH, *LAMPRIS GUTTATUS* (OSTEICHTHYES, LAMPRIDAE), IN THE SOUTHERN PART OF THE INDIAN OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):140-141. 1979. SFA 26(1)
[AzcherNIRO, Kerch, USSR]

81-000663 Suttkus, R. D. and J. V. Conner. THE RAINBOW SMELT, *OSMERUS MORDAX* IN THE LOWER MISSISSIPPI RIVER NEAR ST. FRANCISVILLE, LOUISIANA. *Am. Midl. Nat.* 104(2):394. Oct. 1980. SFA 26(1)
[Mus. Nat. Hist., Tulane Univ., Belle Chasse, LA 70037]

81-000664 Vorobyeva, E. I. OBSERVATIONS ON TWO RHIPIDISTIAN FISHES FROM THE UPPER DEVONIAN OF LODE, LATVIA. *Zool. J. Linn. Soc.* 70(2):191-201. Oct. 1980. SFA 26(1)
[Inst. Evol. Morphol. Anim. Ecol., Akad. Nauk SSSR, Moscow V-71, USSR]

81-000665 Warren, M. L., Jr. THE OCCURRENCE OF THE BANDED PYGMY SUNFISH IN THE GREEN RIVER DRAINAGE OF KENTUCKY. *Trans. Ky. Acad. Sci.* 41(3-4):123-125. Sept. 1980. SFA 26(1)
[Ky. Nat. Preserves Comm., Frankfort 40601] The discovery of an apparent relict population of the banded pygmy sunfish *Elassoma zonatum* is reported from the Cypress Creek drainage, Muhlenberg County, Kentucky (Green River System). This constitutes a range extension of approximately 160 km east in Kentucky. A description of the area demonstrates the close association of the banded pigmy sunfish with cypress swamps.

81-000666 Wenner, C. A.; C. A. Barans, B. W. Stender and F. H. Berry. RESULTS OF MARMAP OTTER TRAWL INVESTIGATIONS IN THE SOUTH ATLANTIC BIGHT. V. SUMMER, 1975. *S.C. Mar. Resour. Cent. Tech. Rep.* No. 45. 57p. Sept. 1980.

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81-000666 CONTINUED SFA 26(1)
[Mar. Resour. Res. Inst., S.C. Wildl. Mar. Resour. Dep., Charleston 29412]

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

81-000667 Cada, G. F. and G. L. Hergenrader. NATURAL MORTALITY RATES OF FRESHWATER DRUM LARVAE IN THE MISSOURI RIVER. *Trans. Am. Fish Soc.* 109(5):479-483. Sept. 1980. SFA 26(1)
[Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

81-000668 Dumont, P.; R. Fortin and H. Fournier. CERTAIN ASPECTS OF THE REPRODUCTION OF UPPER RICHELIEU AND MISSISQUOI BAY NORTHERN PIKE, *ESOX LUCIUS* L. *Proc. Warm Water Workshop Northeast Div. Am. Fish. Soc.* 10:231-248. 1977(1979). SFA 26(1)
[Dep. Biol., Univ. Montreal, PQ, Canada]

81-000669 Fahy, E. 'GROWING SEASON' AS A FACTOR IN SEA TROUT PRODUCTION. *J. Fish Biol.* 17(5):541-546. Nov. 1980. SFA 26(1)
[Fish. Res. Cent., Abbotstown, Castle Knock, Co. Dublin, Ireland] Correlations between mean age at smoltification (MSA) of sea trout post-smolts and length of growing season are presented. The first year of the two-year smolt phase is the more important but the second is also significant as is the year of migration (the third). Strongest correlations are for MSA and the total number of growing days in all three years. A continuous record of calculated MSA from 1916-71 suggests there should have been relatively larger bursts of sea trout production in the 1940's and between 1955 and 1965. The number of trout migrating from one catchment correlates significantly with the number of growing days in the two-year smolt phase.

81-000670 Folmar, H. G.; W. D. Davies and W. L. Shelton. FACTORS AFFECTING ESTIMATES OF FISHING MORTALITY OF LARGEMOUTH BASS IN A SOUTHEASTERN RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:402-407. 1979(1980). SFA 26(1)
[Miss. Bur. Pollut. Control, Unit 121, Turn-Powe Plaza, Pearl 39208] Largemouth bass (*Micropterus salmoides*) were tagged on West Point Reservoir, Alabama-Georga in 1976-1978 to estimate rates of fishing. During the 3 years, several factors affecting these estimates were evaluated. Non-response by anglers who recovered non-reward tags was calculated to be 0.66; tag loss was estimated to occur at an average rate of 4% per week; tagging mortality and displacement of fish while tagging did not appear to affect estimates of fishing mortality.

81-000671 Lindström, T. and E. Bergstrand. THE HABITAT OF PERCH *PERCA FLUVIATILIS* L. ON THE OUTSKIRTS OF ITS SWEDISH DISTRIBUTION, LAKES AND LAKE RESERVOIRS. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 55-76. 1979. SFA 26(1)
[Inst. Freshwater Res., S-170 11 Drottningholm, Sweden]

81-000672 O'Connell, C. P. PERCENTAGE OF STARVING NORTHERN ANCHOVY, *ENGRAULIS MORDAX*, LARVAE IN THE SEA AS ESTIMATED BY HISTOLOGICAL METHODS. *NOAA Fish. Bull.* 78(2):475-489. Apr. 1980. SFA 26(1)

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

81-000672 CONTINUED
[NMFS, P.O. Box 271, La Jolla, CA 92038] The proportion of starving larvae of northern anchovy, *Engraulis mordax*, was estimated for the Southern California Bight in March 1977 from histological examination of larvae of 64 1 m net tow samples. The number of larvae in the tows varied from 0 to about 400. Approximately 6 per tow were sectioned and examined with the light microscope. Twenty-six specimens were identified as emaciated from anomalies of the trunk musculature and digestive tract. Some of the emaciated larvae occurrred as isolated cases at widely scattered locations, but most were from a few nearshore tows, indicating "patches" of starving larvae. Temperature and plankton volume data indicate that the patches were associated with fluctuating environmental conditions. The samples indicate that about 8% of northern anchovy larvae in the Southern California Bight were starving.

81-000673 Solomon, D. J. and D. Paterson. INFLUENCE OF NATURAL AND REGULATED STREAMFLOW ON SURVIVAL OF BROWN TROUT (*SALMO TRUTTA* L.) IN A CHALKSTREAM. *Environ. Biol. Fishes* 5(4):379-382. 8 Dec. 1980. SFA 26(1)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk NR33 0HT, England] Numbers of age 0+ trout in October, and annual survival of fish over 2 years old, were closely correlated with mean April flow (discharge) in a groundwater-fed stream. A pilot flow regulation scheme, which enhanced flows from May to September in a drought year, failed to increase survival.

81-000674 Swanson, B. L. and D. V. Swedberg. DECLINE AND RECOVERY OF THE LAKE SUPERIOR GULL ISLAND REEF LAKE TROUT (*SALVELINUS NAMAYCUSH*) POPULATION AND THE ROLE OF SEA LAMPREY (*PETROMYZON MARINUS*) PREDATION. *Can. J. Fish. Aquatic Sci.* 37(11):2074-2080. Nov. 1980. In English with French summ. SFA 26(1)
[Wis. Dep. Nat. Resour., Bayfield 54814]

81-000675 Turnpenny, A. W. H. and R. Williams. EFFECTS OF SEDIMENTATION ON THE GRAVELS OF AN INDUSTRIAL RIVER SYSTEM. *J. Fish Biol.* 17(6):681-693. Dec. 1980. SFA 26(1)
[Central Electricity Generating Board, Mar. Biol. Lab., Fawley, Hampshire S04 1TW, England] The natural recovery of trout (*Salmo trutta* L.) populations in an industrial river, the Ebbw Fawr, South Wales, has been depressed by problems of natural recruitment. Rainbow trout (*Salmo gairdneri* Richardson) eggs were planted in river gravels to assess the effects of siltation on salmonid spawning success. In reaches were siltation due to the coal industry has occurred, 98-100% of eggs died during incubation in the gravels. Experiments using standpipe techniques measured gravel permeabilities and rates of dissolved oxygen (DO) supply to artifically planted eggs, the results showed a strong dependence of hatching success and alevin size on these two parameters. The median lethal DO supply rate was about 50 $\mu/cm^2/h$.

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81-000676 López S., M. I. *UMBRINA BUSSINGI*, A NEW SCIAENID FISH FROM THE TROPICAL EASTERN PACIFIC OCEAN. *Rev. Biol. Trop.* 28(1):203-208. July 1980. In English with Spanish summ. SFA 26(1)
[Escuela Biol., Univ. Costa Rica, San Ramón, Costa Rica]

81-000677 Ahlstrom, E. H. and H. G. Moser. CHARACTERS USEFUL IN IDENTIFICATION OF PELAGIC MARINE FISH EGGS. *Calif. Coop. Oceanic Fish. Invest.* 21:121-131. July 1980. SFA 26(1)
[H. G. Moser: NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

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81-000678 Bailey, R. M. COMMENTS ON THE CLASSIFICATION AND NOMENCLATURE OF LAMPREYS--AN ALTERNATIVE VIEW. *Can. J. Fish. Aquatic Sci.* 37(11):1626-1629. Nov. 1980. In English with French summ. SFA 26(1)
[Mus. Zool., Univ. Mich., Ann Arbor 48109]

81-000679 Barsukov, V. V. SUBSPECIES OF THE ATLANTIC BLACKBELLY ROSEFISH, *HELICOLENUS DACTYLOPTERUS* (DE LA ROCHE, 1809). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):1-17. 1979. SFA 26(1)
[Zool. Inst., USSR Acad. Sci., Leningrad, USSR]

81-000680 Collares-Pereira, M. J. LES'CHONDROSTOMA À BOUCHE ARQUÉE DE LA PÉNINSULE IBÉRIQUE (AVEC LA DESCRIPTION DE *CH. LUSITANICUM* NOV. SP.) (POISSONS, CYPRINIDAE). [THE ARCHED MOUTH *CHONDROSTOMA* OF THE IBERIAN PENINSULA (WITH DESCRIPTION OF *CH. LUSITANICUM* NOV. SP.) (POISSONS, CYPRINIDAE).] *C. R. Seances Acad. Sci. Ser. D Sci. Nat.* 291(2):275-278. 15 Sept. 1980. In French with English summ. SFA 26(1)
[Lab. Zool., Fac. Ciencias, R. Escola Politec., 1200 Lisbon, Portugal]

81-000681 Dawson, C. E. *KIMBLAEUS*, A NEW PIPEFISH GENUS (SYNGNATHIFORMES: SYNGNATHIDAE) FROM AUSTRALIA, WITH A KEY TO GENERA OF PIPEFISHES WITH CONTINUOUS SUPERIOR RIDGES. *Aust. J. Mar. Freshwater Res.* 31(4):517-523. Sept. 1980. SFA 26(1)
[Gulf Coast Res. Lab. Mus., Ocean Springs, MS 39564]

81-000682 Dawson, C. E. SYNOPSIS OF THE PIPEFISHES (*SYNGNATHIDAE*) OF NEW ZEALAND. *Natl. Mus. N. Z. Rec.* 1(17):281-291. 15 May 1980. SFA 26(1)
[Gulf Coast Res. Lab. Mus., Ocean Springs, MS 39564]

81-000683 Fischer, E. A. SPECIATION IN THE HAMLETS (*HYPOPLECTRUS*: SERRANIDAE)--A CONTINUING ENIGMA. *Copeia* 1980(4):649-659. 5 Dec. 1980. SFA 26(1)
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81-000684 Gomon, J. R. *PARAPERCIS DIPLOSPILUS* (PISCES: MUGILOIDIDAE), A NEW SPECIES FROM THE PHILIPPINE ISLANDS. *Proc. Biol. Soc. Wash.* 93(4):989-996. 16 Jan. 1981. SFA 26(1)
[Dep. Vert. Zool., Natl. Mus. Nat. Hist., Washington, DC 20560]

81-000685 Greenfield, D. W. and L. P. Woods. REVIEW OF THE DEEP-BODIED SPECIES OF *CHROMIS* (PISCES: POMACENTRIDAE) FROM THE EASTERN PACIFIC, WITH DESCRIPTIONS OF THREE NEW SPECIES. *Copeia* 1980(4):626-641. 5 Dec. 1980. SFA 26(1)
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[Dep. Ecol. Evol. Biol., Univ. Ariz., Tucson 85721]

81-000687 Johnson, G. D. XENACANTHODII (CHONDRICHTHYES) FROM THE TECOVAS FORMATION (LATE TRIASSIC) OF WEST TEXAS. *J. Paleontol.* 54(5):923-932. Sept. 1980. SFA 26(1)
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[Univ. Hamburg, Zool. Mus., Martin-Luther-King-Platz 3, 2000 Hamburg 13, West Germany]

81-000689 Kotlyar, A. N. *PARATRACHICHTHYS (AULOTRACHICHTHYS) SAJADEMALENSIS*, A NEW FISH FROM THE FAMILY TRACHICHTHYIDAE (BERYCIFORMES) FROM THE INDIAN OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):137-140. 1979. SFA 26(1)
[VNIRO, Moscow, USSR]

81-000690 Kott, E; R. W. McCauley and G. H Humphries. MORPHOLOGICAL AND PHYSIOLOGICAL (i.e.,UPPER LETHAL TEMPERATURES) COMPARISONS BETWEEN *NOTROPIS CORNUTUS* (MITCHELL) AND *NOTROPIS CHRYSOCEPHALUS* (RAFINESQUE) FROM THE GRAND RIVER, ONTARIO. *Can. J. Zool.* 58(11):2096-2101. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Biol., Wilfrid Laurier Univ., Waterloo, ON N2L 3C5, Canada] Two forms of the *Notropis cornutus* (*Luxilus*) complex occur syntopically in the Grand River system. These have been interpreted by some authors as separate species and by others as subspecies. The forms can be distinguished morphologically by the number of predorsal scales and by pigmentation pattern. It has also been suggested that the upper lethal temperatures of the two differ. This is the first report of a study of these features in syntopic populations. The results indicate that neither physiological nor morphological characters can establish the taxonomic status of these forms and that what is needed is a detailed study of the breeding behaviour of these forms in areas of syntopy.

81-000691 Lea, R. N. SYSTEMATICS AND ZOOGEOGRAPHY OF CUSK-EELS OF THE FAMILY OPHIDIIDAE, SUBFAMILY OPHIDIINAE, FROM THE EASTERN PACIFIC OCEAN. *Ph.D. dissertation, Univ. Miami* 203p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1200. Oct. 1980. SFA 26(1)

81-000692 McEachran, J. D. and L. J. V. Compagno. RESULTS OF THE RESEARCH CRUISES OF FRV "WALTHER HERWIG" TO SOUTH AMERICA. LVI. A NEW SPECIES OF SKATE FROM THE SOUTHWESTERN ATLANTIC, *GURGESIELLA DORSALIFERA* SP. NOV. (CHONDRICHTHYES, RAJOIDEI). *Arch. Fischereiwiss.* 31(1):1-14. July 1980. In English with German summ. SFA 26(1)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

81-000693 Merrett, N. R. A NEW SPECIES OF THE DEEP-SEA FISH GENUS *COELORINCHUS* GIORNA (MACROURIDAE) FROM THE EASTERN NORTH ATLANTIC, WITH NOTES ON ITS ECOLOGY. *J. Fish Biol.* 17(5):553-564. Nov. 1980. SFA 26(1)
[Inst. Oceanogr. Sci., Brook Road, Wormley, Godalming, Surrey GU8 5UB, England]

81-000694 Nijssen, H. and I. J. H. Isbrücker. THREE NEW *CORYDORAS* SPECIES FROM FRENCH GUIANA AND BRAZIL (PISCES, SILURIFORMES, CALLICHTHYIDAE). *Neth. J. Zool.* 30(3):494-503. Sept. 1980. SFA 26(1)
[Inst. Taxonomic Zool., Univ. Amsterdam, The Netherlands]

81-000695 Pietsch, T. W. and J. A. Seigel. CERATIOID ANGLERFISHES OF THE PHILIPPINE ARCHIPELAGO, WITH DESCRIPTIONS OF FIVE NEW SPECIES. *NOAA Fish. Bull.* 78(2):379-399. Apr. 1980. SFA 26(1)
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81-000696 Potter, I. C. THE PETROMYZONIFORMES WITH PARTICULAR REFERENCE TO PAIRED SPECIES. *Can. J. Fish. Aquatic Sci.* 37(11):1595-1615. Nov. 1980. In English with French summ. SFA 26(1)
[Sch. Environ. Life Sci., Murdoch Univ., Murdoch, Western Australia 6153, Australia]

81-000697 Tyler, J. C. OSTEOLOGY, PHYLOGENY, AND HIGHER CLASSIFICATION OF THE FISHES OF THE ORDER PLECTOGNATHI (TETRAODONTIFORMES). *NOAA Tech. Rep. NMFS Circ.* 434. xi + 422p. Oct. 1980. SFA 26(1)
[NMFS, 3300 Whitehaven St., N.W., Washington, DC 20235] The osteology of over 160 species of fossil and Recent plectognath or tetraodoniform fishes is described and illustrated in relation to the supposed phylogeny and proposed higher classification (subfamilial to ordinal levels) of this group of approximately 320 Recent species of primarily tropical and temperate forms of the Atlantic, Pacific, and Indian oceans. The history of the classification and of the previous work on the osteology of the order is reviewed, while one new species (*Acanthopleurus collettei*, Oligocene of Canton Glarus, Switzerland) and one new genus (*Eotetraodon*, Eocene of Monte Bolca, Italy) are described. Comparative inclusive and exclusive definitions are given for all higher categories based on both external and internal anatomical features. The Order Plectognathi (Tetraodontiformes) is divided into two suborders, the Scleroderми or Balistoidei and the Gymnodontes or Tetraodontoidei, with a variety of other infraordinal and superfamilial categories, and 10 families, with subfamilial groupings in 4 of the latter.

81-000698 Vasilieva, E. D. [AN EXPERIENCE OF UTILIZATION OF OSTEOLOGICAL CHARACTERS IN TAXONOMY OF CHARS OF THE GENUS *SALVELINUS* (SALMONIFORMES, SALMONIDAE).] *Zool. Zh.* 59(11):1671-1682. Nov. 1980. In Russian with English summ. SFA 26(1)
[Zool. Mus., State Univ. Moscow, USSR] Osteological methods of evaluation of the taxonomic status of chars of the genus *Salvelinus* utilized by different authors are analyzed. The necessity of preliminary studying the variation of osteological characters at the ontogenetic, population and interpopulation levels is proved. The requirements to the material under study and the treatment of the results obtained are formulated. It is shown using particular examples, that incorrect taxonomic conclusions can be drawn when these requirements are ignored.

81-000699 Vladykov, V. D. and E. Kott. DESCRIPTION AND KEY TO METAMORPHOSED SPECIMENS AND AMMOCOETES OF PETROMYZONIDAE FOUND IN THE GREAT LAKES REGION. *Can. J. Fish. Aquatic Sci.* 37(11):1616-1625. Nov. 1980. In English with French summ. SFA 26(1)
[Univ. Ottawa, Ottawa, ON, Canada]

81-000700 Weitzman, S. H. and J. Géry. THE RELATIONSHIPS OF THE SOUTH AMERICAN PYGMY CHARACOID FISHES OF THE GENUS *ELACHOCHARAX*, WITH A REDESCRIPTION OF *ELACHOCHARAX JUNKI* (TELEOSTEI: CHARACIDAE). *Proc. Biol. Soc. Wash.* 93(4):887-913. 16 Jan. 1981. SFA 26(1)
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81-000701 Weitzman, S. H. and C. A. G. da Cruz. THE SOUTH AMERICAN FISH GENUS *RACHOVISCUS*, WITH A DESCRIPTION OF A NEW SPECIES (TELEOSTEI: CHARACIDAE). *Proc. Biol. Soc. Wash.* 93(4):997-1015. 16 Jan. 1981. SFA 26(1)
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PARASITES AND DISEASES-GENERAL

81-000702 Brienholt, J. C. and R. A. Heckmann. PARASITES FROM TWO SPECIES OF SUCKERS (CATOSTOMIDAE) FROM SOUTHERN UTAH. *Great Basin Nat.* 40(2):149-156. 30 June 1980. SFA 26(1)
[Dep. Zool., Brigham Young Univ., Provo, UT 84602]

81-000703 Grizzle, J. M. FISH HEALTH IN THE TAILWATERS OF BUFORD DAM, GEORGIA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:535-548. 1979(1980). SFA 26(1)
[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

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[Inst. Zool., Tierärztliche Hochsch., D 3000 Hannover, West Germany]

81-000705 Huizinga, H. W. ANTIPARASITIC MECHANISMS OF THE EOSINOPHILIC LEUCOCYTE OF THE GOLDFISH. *Am. Zool.* 20(4):795. 1980. Abstract only. SFA 26(1)
[Ill. State Univ., Normal]

81-000706 Jilek, R. and J. L. Crites. INTESTINAL PARASITES OF THE BLUEGILL, *LEPOMIS MACROCHIRUS*, AND A SUMMARY OF THE PARASITES OF THE BLUEGILL FROM OHIO. *Ohio J. Sci.* 80(6):282-284. Nov. 1980. SFA 26(1)
[Dep. Zool., Ohio State Univ., Columbus 43210]

81-000707 MacKenzie, K. SOME PARASITES AND DISEASES OF BLUE WHITING, *MICROMESISTIUS POUTASSOU* (RISSO), TO THE NORTH AND WEST OF SCOTLAND AND AT THE FAROE ISLANDS. *Scott. Fish. Res. Rep.* No. 17. 14p. 1979. SFA 26(1)
[Mar. Lab., Aberdeen, Scotland]

81-000708 Madhavi, R. COMPARISON OF THE PARASITIC FAUNA OF *APLOCHEILUS PANCHAX* AND *A. MELASTIGMA*. *J. Fish Biol.* 17(4):349-358. Oct. 1980. SFA 26(1)
[Dep. Zool., Univ. Liverpool, P.O. Box 147, Liverpool L69 3BX, England]

81-000709 Mbahinzireki, G. B. OBSERVATIONS ON SOME COMMON PARASITES OF *BAGRUS DOCMAC* FORSKAHL (PISCES: SILUROIDEA) OF LAKE VICTORIA. *Hydrobiologia* 75(3):273-280. 6 Nov. 1980. SFA 26(1)
[Uganda Freshwater Fish. Res. Organ., P.O. Box 343, Jinja, Uganda]

81-000710 Pickering, A. D. and P. Christie. SEXUAL DIFFERENCES IN THE INCIDENCE AND SEVERITY OF ECTOPARASITIC INFESTATION OF THE BROWN TROUT, *SALMO TRUTTA* L. *J. Fish. Biol.* 16(6):669-683. June 1980. SFA 26(1)
[Freshwater Biol. Assoc., Ferry House, Far Sawrey, North Ambleside, Cumbria LA22 0LP England] Hatchery-reared and wild brown trout, *Salmo trutta* L., were examined for skin ectoparasites during their spawning period in 1977 and 1978. A total of eight genera of parasites, comprising five ciliates, one flagellate, one monogenean and one parasitic fungus, were identified with as many as five different genera occurring on a single fish. Sexually mature male fish were more frequently or more severely infested by species of *Ichthyophthirius*, *Scyphidia*, *Gyrodactylus* and *Saprolegnia* than were immature fish of either sex or mature female fish. The differences in

PARASITES AND DISEASES-GENERAL (CONTINUED)

81-000710 CONTINUED ectoparasitic loading could not be correlated with known, seasonal changes in mucus-producing potential of the epidermis. These findings are discussed in relation to the defence mechanisms of teleost fish and to some of the endocrinological changes that occur in salmonid fish during the spawning season.

81-000711 Price, R. L. and R. Jilek. PARASITES OF THE GIZZARD SHAD, *DOROSOMA CEPEDIANUM* LESUEUR, FROM TWO SOUTHERN ILLINOIS LAKES. *Trans. Ill. Acad. Sci.* 72(3):51-52. 1980. SFA 26(1)

[Dep. Zool., South. Ill. Univ., Carbondale 62901] A total of 2849 gizzard shad, *Dorosoma cepedianum*, from two southern Illinois lakes, Crab Orchard and Carlyle, were examined for parasites. Nine different genera were recovered of which *Myxobolus* is reported for the first time from this host and *Pseudanthocotyloides banghami*, *Clinostomum*, *Proteocephalus*, and *Argulus* are reported for the first time from the gizzard shad of Illinois.

81-000712 Price, R. L. and R. Jilek. A CHECKLIST OF PARASITES FROM THE GIZZARD SHAD, *DOROSOMA CEPEDIANUM* LESUEUR. *Trans. Ill. Acad. Sci.* 72(3):53-55. 1980. SFA 26(1)

[Dep. Zool., South. Ill. Univ., Carbondale 62901] A checklist of parasites from the gizzard shad, *Dorosoma cepedianum* is presented. The list consists of 3 species of Protozoa, 11 of Trematoda, 4 of Cestoda, 3 of Acanthocephala, 4 of Nematoda and 5 of Crustacea.

81-000713 Watson, R. A. and T. A. Dick. METAZOAN PARASITES OF PIKE, *ESOX LUCIUS* LINNAEUS, FROM SOUTHERN INDIAN LAKE, MANITOBA, CANADA. *J. Fish Biol.* 17(3):255-261. Sept. 1980. SFA 26(1)

[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada] Metazoan parasites of pike, *Esox lucius* from Southern Indian Lake, Manitoba were studied to reveal species composition, differences with host age, sex, and location and season of capture. Pike hosted 18 species of metazoan parasites, two of which, *Tetraonchus monenteron* and *Proteocephalus pinguis*, made up over 84% of metazoan parasite numbers. Some parasite species exhibited definite patterns of abundance with host age and season which resulted from changes in host diet and behaviour. No differences in parasite abundance existed between the host sexes. Ranking of parasite abundances was significantly different between two sampling sites only 2 km apart as a result of intermediate host distribution. Impoundment could greatly change pike parasite levels. An initial decrease in parasite numbers could be followed by a rapid increase.

81-000714 Wootten, R. and J. W. Smith. STUDIES ON THE PARASITE FAUNA OF JUVENILE ATLANTIC SALMON, *SALMO SALAR* L., CULTURED IN FRESH WATER IN EASTERN SCOTLAND. *Z. Parasitenkd.* 63(3):221-231. Nov. 1980. SFA 26(1)

[Mar. Lab., P.O. Box 101, Aberdeen AB9 8DB, Scotland]

BACTERIAL DISEASES

81-000715 Barham, W. T.; G. L. Smit and H. J. Schoonbee. THE HAEMATOLOGICAL ASSESSMENT OF BACTERIAL INFECTION IN RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Biol.* 17(3):275-281. Sept. 1980. SFA 26(1)

[Dep. Zool., Univ. Zululand, P/bag Kwa-Dlangezwa, 3886 South Africa] The pH, pCO_2 and pO_2 values for diseased fish did not differ

BACTERIAL DISEASES (CONTINUED)

81-000715 CONTINUED significantly from those values for healthy fish, but fish treated with terramycin showed a highly significant rise in pCO_2 with a corresponding fall in pO_2. Haematocrit values, as well as haemoglobin and total plasma protein concentrations were significantly lower in diseased fish while treated fish showed a significant rise in total plasma protein. Glucose concentrations fell very significantly in diseased fish and showed a significant increase in treated fish. The plasma electrolytes, sodium, potassium and chloride, were significantly reduced in diseased fish and potassium levels also fell in treated fish. Diseased fish showed very significantly reduced erythrocyte counts. Of the three parameters MCV, MCH and MCHC, only the values for MCH in diseased fish differed significantly from those for healthy fish.

81-000716 Bullock, A. M. and R. J. Roberts. INHIBITION OF EPIDERMAL MIGRATION IN THE SKIN OF RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN THE PRESENCE OF ACHROMOGENIC *AEROMONAS SALMONICIDA*. *J. Fish Dis.* 3(6):517-524. Nov. 1980. SFA 26(1)
[Dunstaffnage Mar. Res. Lab., Oban, Argyll, Scotland]

81-000717 Bullock, G. L. BACTERIAL KIDNEY DISEASE OF SALMONID FISHES CAUSED BY *RENIBACTERIUM SALMONINARUM*. *U.S. Fish Wildl. Serv. Fish Dis. Leafl.* 60. 10p. 1980. SFA 26(1)

81-000718 Crosa, J. H. *VIBRIO ANGUILLARUM*: AN IRON UPTAKE MECHANISM AS A FACTOR OF VIRULENCE. *Fish Health News* 8(4):vii-x. Oct. 1979. SFA 26(1)
[Dep. Microbiol. Immunol., Sch. Med., Univ. Wash., Seattle 98195]

81-000719 Ellis, A. E. ANTIGEN-TRAPPING IN THE SPLEEN AND KIDNEY OF THE PLAICE *PLEURONECTES PLATESSA* L. *J. Fish Dis.* 3(5):413-426. Sept. 1980. SFA 26(1)
[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

81-000720 Esch, G. W. and T. C. Hazen. STRESS AND BODY CONDITION IN A POPULATION OF LARGEMOUTH BASS: IMPLICATIONS FOR RED-SORE DISEASE. *Trans. Am. Fish. Soc.* 109(5):532-536. Sept. 1980. SFA 26(1)
[Dep. Biol., Wake Forest Univ., Winston-Salem, NC 27109]

81-000721 Goven, B. A.; D. L. Dawe and J. B. Gratzek. PROTECTION OF CHANNEL CATFISH, *ICTALURUS PUNCTATUS* RAFINESQUE, AGAINST *ICHTHYOPHTHIRIUS MULTIFILIIS* FOUQUET BY IMMUNIZATION. *J. Fish Biol.* 17(3):311-316. Sept. 1980. SFA 26(1)
[J. B. Gratzek: Dep. Med. Microbiol., Coll. Vet. Med., Univ. Ga., Athens 30602] Channel catfish, *Ictalurus punctatus* Rafinesque, were immunized with ciliary and whole cell preparations of *Ichthyophthirius multifiliis* and subsequently challenged with *I. multifiliis*. Similar *Tetrahymena pyriformis* preparations were used to determine if this heterologous immunization would elicit a protective immune response against *I. multifiliis* infestation. Results indicate that *T. pyriformis* ciliary antigens provided the greatest degree of protection.

81-000722 Griffin, B. R. AN ENZYME-LINKED ANTIBODY ASSAY FOR DETECTION OF *AEROMONAS SALMONICIDA*. *Fish Health News* 8(3):i-ii. July 1979. SFA 26(1)
[Natl. Fish Health Res. Lab., Kearneysville, WV 25430]

BACTERIAL DISEASES (CONTINUED)

81-000723 Hubbert, R. M. and W. P. Williams. ULCER DISEASE OF ROACH, *RUTILUS RUTILUS* (L.). *Bamidgeh* 32(2):46-52. June 1980. SFA 26(1)
[Chelsea Coll., Univ. London, England] A population of roach *Rutilus rutilus* (L.) with ulcer disease was examined over the course of one year. A bacterium identified as *Aeromonas salmonicida* subsp. *achromogenes* was consistently isolated from ulcers and blood of infected fish but was not present on the skin or in the blood of fish without ulcers.

81-000724 Hunter, V. A.; M. D. Knittel and J. L. Fryer. STRESS-INDUCED TRANSMISSION OF *YERSINIA RUCKERI* INFECTION FROM CARRIERS TO RECIPIENT STEELHEAD TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 3(6):467-472. Nov. 1980. SFA 26(1)
[M. D. Knittel: U.S. EPA, Corvallis Environ. Res. Lab. Freshwater Div., Toxicol. Br., Corvallis, OR 97350] The transmission of *Yersinia ruckeri* has been investigated in steelhead trout using asymptomatic carriers of the causative bacterium of enteric redmouth disease. It was found that unstressed carrier fish did not transmit the bacterium to recipient fish to cause either an epizootic or produce new carrier fish. However, when the carriers were stressed with heat, the bacterium was transmitted from the carrier to recipient fish producing a lower intestinal carrier state but no deaths. Examination of experimentally infected fish to determine the number of carriers among the survivors indicated that the frequency varied as a function of time following infection. When immunized fish were challenged with *Y. ruckeri* they became temporary carriers of the bacterium for up to 3 days; but were not able to transmit the infection to healthy recipient fish.

81-000725 Kusuda, R. and Y. Fukuda. [AGGLUTINATING ANTIBODY TITERS AND SERUM PROTEIN CHANGES OF YELLOWTAIL AFTER IMMUNIZATION WITH *PASTEURELLA PISCICIDA* CELLS.] *Bull. Jpn. Soc. Sci. Fish.* 46(7):801-807. July 1980. In Japanese with English summ. SFA 26(1)
[Fish. Dis. Lab., Fac. Agric., Kochi Univ., Nankoku, Kochi 783, Japan]

81-000726 Kusuda, R.; K. Kawai and T. Itami. EFFICACY OF BATH-IMMUNIZATION AGAINST VIBRIOSIS IN CULTURED AYU. *Bull. Jpn. Soc. Sci. Fish.* 46(8):1053. Aug. 1980. SFA 26(1)
[Fish. Dis. Lab., Fac. Agric., Kochi Univ., Nankoku, Kochi 783, Japan]

81-000727 Lallier, R.; Y. Boulanger and G. Olivier. DIFFERENCE IN VIRULENCE OF *AEROMONAS HYDROPHILA* AND *AEROMONAS SOBRIA* IN RAINBOW TROUT. *Prog. Fish-Cult.* 42(4):199-200. Oct. 1980. SFA 26(1)
[Dep. Pathol. Microbiol., Fac. Vet. Med., Univ. Montreal, St. Hyacinthe, PQ J2S 7C6, Canada]

81-000728 O'Neill, J. G. BLOOD CLEARANCE OF MS2 BACTERIOPHAGE IN *SALMO TRUTTA*: A PARADOXON. *Experientia (Basel)* 36(10):1226-1227. 15 Oct. 1980. SFA 26(1)
[Dep. Life Sci., Trent Polytech., Nottingham NG1 4BU, England] A primary challenge of MS2 bacteriophage was cleared from the blood of the teleost *Salmo trutta* within 2.5 days. In contrast the clearance of a 2nd challenge required an extra 3.5 days and the induction of the secondary antibody response was delayed, though immune memory was observed later.

81-000729 Sanders, J. E. and J. L. Fryer. THE TAXONOMIC POSITION OF THE CAUSATIVE AGENT OF BACTERIAL KIDNEY DISEASE. *Fish Health News* 9(1):vii. Jan. 1980. SFA 26(1)
[Dep. Microbiol., Nash Hall, Oreg. State Univ., Corvallis 97331]

BACTERIAL DISEASES (CONTINUED)

81-000730 Schneider, R. and B. L. Nicholson. BACTERIA ASSOCIATED WITH FIN ROT DISEASE IN HATCHERY-REARED ATLANTIC SALMON (*SALMO SALAR*). *Can. J. Fish. Aquatic Sci.* 37(10):1505-1513. Oct. 1980. In English with French summ. SFA 26(1)
[B. L. Nicholson: Migratory Fish Res. Inst., Univ. Me., Orono 04469]

81-000731 Secombes, C. J. and M. J. Manning. COMPARATIVE STUDIES ON THE IMMUNE SYSTEM OF FISHES AND AMPHIBIANS: ANTIGEN LOCALIZATION IN THE CARP *CYPRINUS CARPIO* L. *J. Fish Dis.* 3(5):399-412. Sept. 1980. SFA 26(1)
[Dep. Zool., Univ. Hull HU6 7RX, England] Antigen localization studies in the mirror carp *Cyprinus carpio* were carried out using a soluble antigen, human gamma globulin and a cellular bacterial antigen, *Aeromonas salmonicida*. Antigen was detected using direct single layer and indirect double layer immunofluorescent techniques, respectively. A study of the spleen, pronephros, mesonephros, liver and thymus at various times after administration of the antigen showed that fluorescence occurs mainly in the ellipsoids of the spleen and in the haemopoietic parenchyma of the pronephros and mesonephros and reaches its greatest intensity when antibody titres are relatively high. A direct comparison with antigen localization in the clawed toad *Xenopus laevis*, has enabled us to analyse possible evolutionary trends towards the complex dendritic retention of antigen seen in the higher vertebrates.

81-000732 Viele, D.; T. H. Kerstetter and J. Sullivan. ADOPTIVE TRANSFER OF IMMUNITY AGAINST *VIBRIO ANGUILLARUM* IN RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON, VACCINATED BY THE IMMERSION METHOD. *J. Fish Biol.* 17(4):379-386. Oct. 1980. SFA 26(1)
[T. H. Kerstetter: Dep. Fish., Humboldt State Univ., Arcata, CA 95521] Rainbow trout, immunized by the immersion method against *Vibrio anguillarum*, were used as donors of plasma and cells for transfer to unimmunized trout. Recipients were then challenged with a 20 min. exposure to a virulent *Vibrio anguillarum* suspension, and the mortality was compared to that of trout receiving plasma and cells from unimmunized donors. Immunity was successfully conferred by plasma taken from immune donors 16 days post-immunization (PI), and by pronephros and spleen cells from Day 20 and 21 PI donors. Plasma was most effective in transferring vibriosis protection, followed by pronephros cells. Splenocytes gave variable results, while trials with thymus cells were negative in all cases.

81-000733 Wakabayashi, H.; S. Egusa and J. L. Fryer. CHARACTERISTICS OF FILAMENTOUS BACTERIA ISOLATED FROM A GILL DISEASE OF SALMONIDS. *Can. J. Fish. Aquatic Sci.* 37(10):1499-1504. Oct. 1980. In English with French summ. SFA 26(1)
[Dep. Fish., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

81-000734 Walters, G. R. and J. A. Plumb. ENVIRONMENTAL STRESS AND BACTERIAL INFECTION IN CHANNEL CATFISH, *ICTALURUS PUNCTATUS* RAFINESQUE. *J. Fish Biol.* 17(2):177-185. Aug. 1980. SFA 26(1)
[224 Townhouse, Briarcrest, Hershey, PA 17033] Channel catfish, *Ictalurus punctatus*, were injected intraperitoneally with a sublethal dose of *Aeromonas hydrophila* and then stressed for 144 h by being maintained either in a dissolved oxygen concentration of 1.5 mg/l, 1.2 mg/l total ammonia, and/or 6.5 mg/l free CO_2 with a continuous inflow of water. A significant difference in percentage of mortality was noted between treatments ($P \leq 0.05$). The trunk kidneys of surviving stressed fish had significantly higher total bacterial counts than non-stressed controls. *A. hydrophila* was isolated from 67% of the stressed fish and 9% of the control fish. *Edwardsiella tarda*, apparently endemic in the population, was isolated from 43% of the stressed fish and 7% of the control fish. Histopathological lesions were in the gills, liver, spleen, trunk kidney, and head kidney of stressed fish, but not control fish.

FUNGAL DISEASES

81-000735 Srivastava, R. C. FUNGAL PARASITES OF CERTAIN FRESH WATER FISHES OF INDIA. *Aquaculture* 21(4):387-392. Dec. 1980. SFA 26(1)
[Bot. Surv. India, Allahabad-211002, India]

PROTOZOAN DISEASES

81-000736 Conroy, D. A.; C. Vásquez and J. Morales. THE USE OF NIFURPIRINOL IN THE CONTROL OF CHILODONELLIASIS AND ICHTHYOPHTHIRIASIS IN SPECIES OF COLOMBIAN COLD WATER FISH. *J. Fish Dis.* 3(6):531-532. Nov. 1980. SFA 26(1)
[Sec. Ictiopathol., Fac. Cienc. Vet., Univ. Cent. Venezuela, Apt. Correos No. 4563, Maracay 2 KO, Edo. Aragua, Venezuela]

81-000737 Egusa, S. and K. Nakajima. *KUDOA AMAMIENSIS* N. SP. (MYXOSPOREA: MULTIVALVULIDA) FOUND IN CULTURED YELLOWTAILS AND WILD DAMSELFISHES FROM AMAMI-OHSHIMA AND OKINAWA, JAPAN. *Bull. Jpn. Soc. Sci. Fish.* 46(10):1193-1198. Oct. 1980. SFA 26(1)
[Lab. Fish. Pathol., Nippon Vet. Zootech. Coll., Musashino, Tokyo 180, Japan]

81-000738 Huff, J. A. and C. D. Burns. HYPERSALINE AND CHEMICAL CONTROL OF *CRYPTOCARYON IRRITANS* IN RED SNAPPER, *LUTJANUS CAMPECHANUS*, MONOCULTURE. *Aquaculture* 22(1-2):181-184. Jan. 1981. SFA 26(1)
[Fla. Dep. Nat. Resour., Mar. Res. Lab., 100 Eighth Ave. SE, St. Petersburg 33701] Epizootics of the holotrichous ciliate, *Cryptocaryon irritans*, have impeded monoculture of red snapper, *Lutjanus campechanus*, at the Florida Department of Natural Resources facilities in St. Petersburg, Florida. Cryptocaryoniasis was associated with most mortalities and was controlled only in one group of red snapper being conditioned for induced spawning. An effective treatment regime which has prevented recurring *Cryptocaryon* infections included hypersalinity, quinine hydrochloride, chloroquine, and minimal handling.

81-000739 Khan, R. A. THE LEECH AS A VECTOR OF A FISH PIROPLASM. *Can. J. Zool.* 58(9):1631-1637. In English with French summ. SFA 26(1)
[Dep. Biol., Memorial Univ., St. John's, NF A1C 5S7, Canada]

81-000740 Khan, R. A.; J. Murphy and D. Taylor. PREVALENCE OF A TRYPANOSOME IN ATLANTIC COD (*GADUS MORHUA*) ESPECIALLY IN RELATION TO STOCKS IN THE NEWFOUNDLAND AREA. *Can. J. Fish. Aquatic Sci.* 37(10):1467-1475. Oct. 1980. In English with French summ. SFA 26(1)
[Dep. Biol., Memorial Univ., St. John's, NF A1C 5S7, Canada]

81-000741 Konagaya, S. [JELLIFICATION AND PROTEASE ACTIVITY OF YELLOWFIN SOLE MUSCLE IN ASSOCIATION WITH MYXOSPORIDIAN PARASITE.] *Bull. Jpn. Soc. Sci. Fish.* 46(8):1019-1026. Aug. 1980. In Japanese with English summ. SFA

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81-000741 CONTINUED 26(1)
[Tokai Reg. Fish. Res. Lab., Kachidoki-5, Chuo-ku, Tokyo 104, Japan]

81-000742 Lom, J. *CRYPTOBIA BRANCHIALIS* NIE FROM FISH GILLS: ULTRASTRUCTURAL EVIDENCE OF ECTOCOMMENSAL FUNCTION. *J. Fish Dis.* 3(5):427-436. Sept. 1980. SFA 26(1)
[Inst. Parasitol., Czech. Acad. Sci., Flemingovo nám. 2, 166 32 Praha 6, Czechoslovakia]

81-000743 Lowe-Jinde, L. OBSERVATIONS OF RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON, INFECTED WITH *CRYPTOBIA SALMOSITICA*. *J. Fish Biol.* 17(1):23-30. July 1980. SFA 26(1)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Rainbow trout, *Salmo gairdneri*, were experimentally infected with *Cryptobia salmositica*. The parasitaemia was associated with increases in the size of the spleen, liver and heart (% body weight). The splenomegaly was pronounced and was often 600-fold larger. The amounts of blood lactic acid and lactate dehydrogenase in the infected and control fish were similar. However, glycogen levels of the liver, heart and epaxial muscle declined. Liver glycogen levels were most affected and decreased to values which represented 20% of the control values. The pattern of the glycogen levels of the liver, heart and epaxial muscle declined to rise to normal values by day 56 post-inoculation. Thus, the glycogen levels both paralleled the acute parasitaemia and the subsequent partial recovery of the infected fish as they tolerated a low chronic parasitaemia.

81-000744 Matthews, R. A. and B. F. Matthews. CELL AND TISSUE REACTIONS OF TURBOT *SCOPHTHALMUS MAXIMUS* (L.) TO *TETRAMICRA BREVIFILUM* GEN. N., SP. N. (MICROSPORA). *J. Fish Dis.* 3(6):495-515. Nov. 1980. SFA 26(1)
[Unit. Fish Dis., Dep. Biol. Sci., Phymouth Polytech., Drake Circus, Plymouth PL4 8AA, Devon, England]

81-000745 McVicar, A. H. and R. Wootten. *DERMOCYSTIDIUM* DISEASE OF PROPAGATED ATLANTIC SALMON. *Fish Health News* 8(4):iv-vi. Oct. 1979. SFA 26(1)
[Dep. Agric. Fish. Scotland, Mar. Lab., Aberdeen AB9 8DB, Scotland]

81-000746 Paperna, I. *AMYLOODINIUM OCELLATUM* (BROWN, 1931) (DINOFLAGELLIDA) INFESTATIONS IN CULTURED MARINE FISH AT EILAT, RED SEA: EPIZOOTIOLOGY AND PATHOLOGY. *J. Fish Dis.* 3(5):363-372. Sept. 1980. SFA 26(1)
[Steinitz Mar. Biol. Lab., Hebrew Univ. Jerusalem, Eilat, Israel] Since 1977, repeated outbreaks of infestation by *Amyloodinium ocellatum* (Dinoflagellida) in cultured gilthead bream *Sparus aurata* L. and seabass *Dicentrarchus labrax* (L.) resulted in sporadic and mass mortalities. Fingerlings and yearlings as well as breeders were affected and, since 1978, larval and post-larval *S. aurata* in the hatchery. Infestations in juvenile and breeder fish were located predominantly on the gills and nucosal integument but in larval fish only the skin rather than the gills were infested. Histopathological changes of the infested gills are described. Vacuolar degeneration of the cells penetrated by the parasites' rhizoids was evident at the site of attachment and cloudy swelling was apparent in the surrounding epithelial cells. In heavy infestations the entire epithelium of the gill filaments underwent hyperplasia with consequent fusion of the lamellae. Where hyperplasia was extensive the cells gradually degenerated

PROTOZOAN DISEASES (CONTINUED)

81-000746 CONTINUED while the inner epithelial layer showed distinct spongiosis and in some cases completely disintegrated. All heavily infested gills lacked mucous cells.

VIRAL DISEASES

81-000747 Benz, G. W. TISSUE PROLIFERATIONS ASSOCIATED WITH *NEMESIS LAMNA* RISSO, 1826 (COPEPODA: EUDACTYLINIDAE) INFESTATIONS ON THE GILL FILAMENTS OF SHORTFIN MAKOS (*ISURUS OXYRINCHUS* RAFINESQUE). *J. Fish Dis.* 3(5):443-446. Sept. 1980. SFA 26(1)
[Dep. Zool., Univ. Md., College Park 20742]

81-000748 Kawatsu, H. and T. Sakai. HYPERBILIRUBINEMIA IN CULTURED EEL. *Bull. Jpn. Soc. Sci. Fish.* 46(7):809-812. July 1980. SFA 26(1)
[Fac. Agric., Miyazaki Univ., 210 Funatsuka-3, Miyazaki 880, Japan]

81-000749 Kimura, T.; M. Yoshimizu and M. Tanaka. SALMONID VIRUSES: A SYNCYTIUM-FORMING HERPESVIRUS FROM LANDLOCKED *ONCORHYNCHUS MASOU*. *Fish Health News* 9(1):iii. Jan. 1980. SFA 26(1)
[Fac. Fish., Hokkaido Univ., Hakodate, Japan]

81-000750 Kimura, T.; M. Yoshimizu and M. Tanaka. SALMONID VIRUSES: EFFECTS OF *ONCORHYNCHUS MASOU* VIRUS (OMV) IN FRY OF CHUM SALMON (*ONCORHYNCHUS KETA*). *Fish Health News* 9(1):i-iii. Jan. 1980. SFA 26(1)
[Fac. Fish., Hokkaido Univ., Hakodate, Japan]

81-000751 Leibovitz, L. and R. C. Riis. A NEW VIRAL DISEASE OF AQUARIUM FISH. *Fish Health News* 9(1):iv-vi. Jan. 1980. SFA 26(1)
[Dep. Avian Aquatic Anim. Med., N.Y. State Coll. Vet. Med., Cornell Univ., Ithaca 14853]

81-000752 Mulcahy, D. M.; G. L. Tebbit; W. J. Groberg, Jr.,; J. S. McMichael; J. R. Winton; R. P. Hedrick; M. Philippon-Fried; K. S. Pilcher and J. L. Fryer. THE OCCURRENCE AND DISTRIBUTION OF SALMONID VIRUSES IN OREGON. *Oreg. Agric. Exp. Stn. Tech. Pap.* No. 5504. 71p. Aug. 1980. Available as ORESU-T-80-004 @ $2.00 from Sea Grant Prog., Oreg. State Univ. AdS 320, Corvallis 97331. SFA 26(1)

81-000753 Robin, J. and A. Rodrigue. RESISTANCE OF HERPES CHANNEL CATFISH VIRUS (HCCV) TO TEMPERATURE, pH, SALINITY AND ULTRAVIOLET IRRADIATION. *Rev. Can. Biol.* 39(3):153-156. Sept. 1980. In English with French summ. SFA 26(1)
[Dep. Biol., Fac. Sci., Univ. Sherbrooke, Sherbrooke, PQ J1K 2R1, Canada]
The effect of temperature, pH, salinity and ultraviolet irradiation of the infectivity of Herpes Channel Catfish Virus (HCCV) has been determined. It has been shown that the pH and the culture medium is an important factor in maintaining virus infectivity. The temperatures higher than 4°C rapidly inactiviate the virus while this one can be grown successfully after several months of storage at -75°C and at -20°C. In common with other herpesviruses, HCCV is quickly inactivated by UV irradiation. The signification of these findings on the mode of viral infection and of viral harvesting, disinfection measures and marine farming of Ictalurids is important.

VIRAL DISEASES (CONTINUED)

81-000754 Savan, M. and P. Dobos. EFFECT OF VIRAZOLE ON RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON FRY INFECTED WITH INFECTIOUS PANCREATIC NECROSIS VIRUS. *J. Fish Dis.* 3(5):437-440. Sept. 1980. SFA 26(1)
[Dep. Vet. Microbiol. Immunol., Univ. Guelph, Guelph, ON NIG 2WI, Canada]

81-000755 Shariff, M.; R. H. Richards and C. Sommerville. THE HISTOPATHOLOGY OF ACUTE AND CHRONIC INFECTIONS OF RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON WITH EYE FLUKES, *DIPLOSTOMUM* SPP. *J. Fish Dis.* 3(6):455-465. Nov. 1980. SFA 26(1)
[R. H. Richards: Inst. Aquacult., Univ. Stirling, Stirling FK9 4LA, Scotland]

81-000756 Stephens, E. B.; N. W. Newman; A. L. Zachary and F. M. Hetrick. A VIRAL AETIOLOGY FOR THE ANNUAL SPRING EPIZOOTICS OF ATLANTIC MENHADEN *BREVOORTIA TYRANNUS* (LATROBE) IN CHESAPEAKE BAY. *J. Fish Dis.* 3(5):387-398. Sept. 1980. SFA 26(1)
[F. M. Hetrick: Dep. Microbiol., Univ. Md., College Park 20742] Virus was isolated from the brain and pancreatic tissues of Atlantic menhaden with 'spinning' disease. The biological, physical and chemical properties of the isolate were similar to those of infectious pancreatic necrosis virus. Inoculation of the virus into healthy menhaden resulted in the characteristic signs and mortality associated with the natural disease.

OTHER DISEASES AND PARASITES

81-000757 Alexander, J. B. PRECIPITINS IN THE SERUM OF THE ATLANTIC SALMON. *Dev. Comp. Immunol.* 4(4):641-651. 1980. SFA 26(1)
[Dep. Biol., Univ. Salford, Gardner St. Annexe, Salford, M6 6WZ, England]

81-000758 Andrews, C. and J. C. Chubb. OBSERVATIONS ON THE DEVELOPMENT OF *BUNODERA LUCIOPERCAE* (MÜLLER, 1776) (TREMATODA: ALLOCREADIIDAE) UNDER FIELD AND LABORATORY CONDITIONS. *J. Fish Dis.* 3(6):481-493. Nov. 1980. SFA 26(1)
[Yorkshire Water Auth., Olympia House, Gelderd Rd., Leeds LS12 6DD, Yorkshire, England]

81-000759 Bouck, G. R. ETIOLOGY OF GAS BUBBLE DISEASE. *Trans. Am. Fish. Soc.* 109(6):703-707. Nov. 1980. SFA 26(1)
[U.S. FWS, Natl. Fish. Res. Cent., Bldg. 204, Naval Support Activity, Seattle, WA 98115]

81-000760 Bouck, G. R.; B. D'Aoust; W. J. Ebel and R. Rulifson. ATMOSPHERIC GAS SUPERSATURATION: EDUCATIONAL AND RESEARCH NEEDS. *Trans. Am. Fish. Soc.* 109(6):769-771. Nov. 1980. SFA 26(1)
[U.S. FWS, Natl. Fish. Res. Cent., Bldg. 204, Naval Support Activity, Seattle, WA 98115]

81-000761 Brooks, D. R.; M. A. Mayes and T. B. Thorson. CESTODE PARASITES IN *MYLIOBATIS GOODEI* GARMAN (MYLIOBATIFORMES: MYLIOBATIDAE) FROM RÍO DE LA PLATA, URUGUAY, WITH A SUMMARY OF CESTODES COLLECTED FROM SOUTH AMERICAN ELASMOBRANCHS DURING 1975-1979. *Proc. Biol. Soc. Wash.* 93(4):1239-1252. 16 Jan. 1981. SFA 26(1)
[Dep. Zool., Univ. British Columbia, 2075 Westbrook Mall, Vancouver, BC V6T 1W5, Canada]

OTHER DISEASES AND PARASITES (CONTINUED)

81-000762 Buttner, J. K. OCCURRENCE OF *ARGULUS* (CRUSTACEA: BRANCHIURA) ON THE WHITE CRAPPIE, *POMOXIS ANNULARIS* RAFINESQUE, AND FREE-SWIMMING IN THE SOUTHERN ILLINOIS RESERVOIRS. *Trans. Ill. Acad. Sci.* 72(3):5-7. 1980.
[Coop. Fish Res. Lab., South. Ill. Univ., Carbondale 62901]

81-000763 Bylund, G.; E. T. Valtonen and E. Niemelä. OBSERVATIONS ON EPIDERMAL PAPILLOMATA IN WILD AND CULTURED ATLANTIC SALMON *SALMO SALAR* L. IN FINLAND. *J. Fish Dis.* 3(6):525-528. Nov. 1980. SFA 26(1)
[Inst. Parasitol., Åbo Akad., SF-20500 Åbo 50, Finland]

81-000764 Camp, J. W. STUDIES ON THE POPULATION BIOLOGY OF *DIPLOSTOMULUM SCHEURINGI* IN MOSQUITOFISH, *GAMBUSIA AFFINIS*. *Ph.D. dissertation, Wake Forest Univ.* 123p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(6):2023. Dec. 1980. SFA 26(1)

81-000765 Chamberlain, G. W.; W. H. Neill; P. A. Romanowsky and K. Strawn. VERTICAL RESPONSES OF ATLANTIC CROAKER TO GAS SUPERSATURATION AND TEMPERATURE CHANGE. *Trans. Am. Fish. Soc.* 109(6):737-750. Nov. 1980. SFA 26(1)
[Tex. A&M Maricult. Facility, 4301 Waldron Rd., Corpus Christi 78418]

81-000766 Crunkilton, R. L.; J. M. Czarnezki and L. Trial. SEVERE GAS BUBBLE DISEASE IN A WARMWATER FISHERY IN THE MIDWESTERN UNITED STATES. *Trans. Am. Fish. Soc.* 109(6):725-733. Nov. 1980. SFA 26(1)
[Mo. Dep. Conserv., 1110 College Ave., Columbia 65201]

81-000767 D'Aoust, B. G. and M. J. R. Clark. ANALYSIS OF SUPERSATURATED AIR IN NATURAL WATERS AND RESERVOIRS. *Trans. Am. Fish. Soc.* 109(6):708-724. Nov. 1980. SFA 26(1)
[Dep. Hyperbaric Physiol., Virginia Mason Res. Cent., Seattle, WA 98101]

81-000768 Davey, J. T. SPATIAL DISTRIBUTION OF THE COPEPOD PARASITE *LERNANTHROPUS KROYERI* ON THE GILLS OF BASS, *DICENTRARCHUS LABRAX* (L.). *J. Mar. Biol. Assoc. U.K.* 60(4):1061-1067. Nov. 1980. SFA 26(1)

81-000769 Fickeisen, D. H. and M. J. Schneider. GAS BUBBLE DISEASE. INTRODUCTION. *Trans. Am. Fish. Soc.* 109(6):657-658. Nov. 1980. SFA 26(1)
[Ecol. Sci. Dep., Battelle Pac. Northwest Lab., Richland, WA 99352]

81-000770 Fischthal, J. H.; B. L. Fish and R. S. Vaught. COMPARATIVE ALLOMETRIC GROWTH OF THE DIGENETIC TREMATODE *METADENA GLOBOSA* (LINTON 1910) MANTER 1947 (CRYPTOGONIMIDAE) IN THREE SPECIES OF CARIBBEAN FISHES. *J. Parasitol.* 66(4):642-644. Aug. 1980. SFA 26(1)
[Dep. Biol. Sci., State Univ. N.Y., Binghamton 13901]

81-000771 Ghittino, P.; S. Andruetto and E. Vigliani. DISCUSSIONE CRITICA SULLA MALATTIA DELL'INGROSSAMENTO RENALE DELLA TROTA ALLA LUCE DI RECENTI ESPERIMENTI. [A CRITICAL DISCUSSION ABOUT THE KIDNEY SWELLING DISEASE OF TROUT, ON THE LIGHT OF RECENT STUDIES.] *Riv. It. Piscic. Ittiop.* 15(3):81-85. July-Aug.-Sept. 1980. In Italian with English summ. SFA 26(1)
[Ist. Zooprof. Sper., Via Bologna 148-10154 Torino, Italy]

81-000772 Knittel, M. D.; G. A. Chapman and R. R. Garton. EFFECTS OF HYDROSTATIC PRESSURE ON STEELHEAD SURVIVAL IN AIR-SUPERSATURATED WATER. *Trans. Am. Fish. Soc.* 109(6):755-759. Nov. 1980. SFA 26(1)

OTHER DISEASES AND PARASITES (CONTINUED)

81-000772 CONTINUED
[U.S. EPA, West. Fish Toxicol. Stn., 1350 Southeast Goodnight Ave., Corvallis, OR 97330]

81-000773 Mayes, M. A. and D. R. Brooks. CESTODE PARASITES OF SOME VENEZUELAN STINGRAYS. *Proc. Biol. Soc. Wash.* 93(4):1230-1238. 16 Jan. 1981. SFA 26(1)
[Environ. Sci. Res., 1702 Bldg., Dow Chemical, Midland, MI 48640]

81-000774 Mills, C. A. AGE- AND DENSITY-DEPENDENT GROWTH WITHIN POPULATIONS OF THE ECTOPARASITIC DIGENEAN *TRANSVERSOTREMA PATIALENSE* ON THE FISH HOST. *Int. J. Parasitol.* 10(4):287-291. Aug. 1980. SFA 26(1)
[Freshwater Biol. Assoc., River Lab., East Stoke, Wareham, Dorset BH20 6BB, England]

81-000775 Montgomery, J. C. and C. D. Becker. GAS BUBBLE DISEASE IN SMALLMOUTH BASS AND NORTHERN SQUAWFISH FROM THE SNAKE AND COLUMBIA RIVERS. *Trans. Am. Fish. Soc.* 109(6):734-736. Nov. 1980. SFA 26(1)
[Ecol. Sci. Dep., Battelle Pac. Northwest Lab., Richland, WA 99352]

81-000776 Nebeker, A. V.; A. K. Hauck; F. D. Baker and S. L. Weitz. COMPARATIVE RESPONSES OF SPECKLED DACE AND CUTTHROAT TROUT TO AIR-SUPERSATURATED WATER. *Trans. Am. Fish. Soc.* 109(6):760-764. Nov. 1980. SFA 26(1)
[U.S. EPA, West. Fish Toxicol. Stn., 1350 Southeast Goodnight Ave., Corvallis, OR 97330]

81-000777 Peck, T. H. and R. J. Klauda. ARE PCB'S RESPONSIBLE FOR THE HIGH INCIDENCE OF HEPATOCELLULAR CARCINOMA OBSERVED IN HUDSON RIVER ATLANTIC TOMCOD? *Presented at Symposium on Pollution of Ground Surface Waters, Ramapo College, Mahwah, New Jersey. 1-2 May 1980.* SFA 26(1)
[Texas Instruments Inc., P.O. Box 237, Buchanan, NY 10511] Visual observations of Atlantic tomcod collected during the 1977-78 spawning season in the Hudson River, New York, revealed a relatively high proportion of abnormal livers. Histological examinations revealed an estimated incidence of 25% with hepatocellular carcinoma (hepatoma). PCB's, known to exist in elevated levels in the Hudson River, were suspected to be associated with this high incidence of hepatoma. To evaluate this hypothesis, the liver abnormalities were placed into four categories based on gross external appearance (normal, hemorrhagic, small pustules and tumors). Liver, gonadal and body tissues were removed from twelve tomcod, three from each of the four liver categories, and individually analyzed for PCB content. Livers contained concentrations of PCB's (Aroclor 1016 and 1454) ranging from 10.9 to 98.2 ppm (mean of 37.5 ppm), but PCB levels in the bodies and gonads were generally less than 1 ppm. No detectable relationship between liver category and PCB concentration was found. A significant inverse correlation was found between total length (sexes combined) and PCB concentration in the liber, but there was not significant correlation between total length and PCB concentration in either body or gonadal tissues. Evidence for a causative association between hepatoma in Atlantic tomcod and PCB's is only circumstantial at the present time; the principle clue being the higher concentrations of PCB's in the liver relative to the other tissues.

81-000778 Price, R. L. and J. K. Buttner. FIRST REPORTED OCCURRENCE OF *ARGULUS MISSISSIPPIENSIS* (CRUSTACEA: BRANCHIURA) FROM ILLINOIS. *Trans. Ill. Acad. Sci.* 72(3):8. 1980. SFA 26(1)
[Dep. Zool., South. Ill. Univ., Carbondale 62901]

OTHER DISEASES AND PARASITES (CONTINUED)

81-000779 Radabaugh, D. C. CHANGES IN MINNOW, *PIMEPHALES PROMELAS* RAFINESQUE, SCHOOLING BEHAVIOUR ASSOCIATED WITH INFECTIONS OF BRAIN-ENCYSTED LARVAE OF THE FLUKE, *ORNITHODIPLOSTOMUM PTYCHOCHEILUS*. *J. Fish Biol.* 16(6):612-628. June 1980. SFA 26(1)
[Dep. Zool., Ohio Wesleyan Univ., Delaware, OH 43015] The schooling behaviour of unparasitized fathead minnows, *Pimephales promelas* Rafinesque, was compared to that of minnows infected with brain-dwelling metacercariae of the fluke, *Ornithodiplostomum ptychocheilus* (Faust). Laboratory results showed that schools of infected fish divided more frequently, were less compact, and occupied positions closer to the water surface than control schools. These results are discussed with reference to the possibility that this larval parasite manipulates minnow behaviour to increase host vulnerability to predation.

81-000780 Soutter, A. M.; M. Walkey and C. Arme. AMINO ACIDS IN THE PLEROCERCOID OF *LIGULA INTESTINALIS* (CESTODA: PSEUDOPHYLLIDAE) AND ITS FISH HOST, *RUTILUS RUTILUS*. *Z. Parasitenkd.* 63(2):151-158. Oct. 1980. SFA 26(1)
[M. Walkey: Dep. Zool. Comp. Physiol., Queen Mary Coll., Mile End Road, London E1 4N5, England]

81-000781 Stevens, D. G.; A. V. Nebeker and R. J. Baker. AVOIDANCE RESPONSES OF SALMON AND TROUT TO AIR-SUPERSATURATED WATER. *Trans. Am. Fish. Soc.* 109(6):751-754. Nov. 1980. SFA 26(1)
[U.S. EPA, West. Fish Toxicol. Stn., 1350 Southeast Goodnight Ave., Corvallis, OR 97330]

81-000782 Terekhov, P. A. CONTRACAECUM INFESTATION IN THE AZOV ANCHOVY, *ENGRAULIS ENCRASICHOLUS MAEOTICUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):170-172. 1979. SFA 26(1)
[AZNIIRKh, Rostov-on-Don, USSR]

81-000783 Timmons, T. J. and W. G. Hemstreet. PREVALENCE RATE OF *LERNAEA CYPRINACEA* L. (COPEPODA: LERNAEIDAE) ON YOUNG-OF-THE-YEAR LARGEMOUTH BASS, *MICROPTERUS SALMOIDES* (LACÉPÈDE), IN WEST POINT RESERVOIR, ALABAMA-GEORGIA, U.S.A. *J. Fish Dis.* 3(6):529-530. Nov. 1980. SFA 26(1)
[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36849]

81-000784 Valtonen. E. T. *METECHINORHYNCHUS SALMONIS* INFECTION AND DIET IN THE RIVER-SPAWNING WHITEFISH OF THE BOTHNIAN BAY. *J. Fish Biol.* 17(1):1-8. July 1980. SFA 26(1)
[Dep. Zool., Univ. Oulu, Finland] A total of 206 river-spawning whitefish *Coregonus lavaretus* (L.) from the Bothnian Bay was investigated for food objects and acanthocephalans in the years 1975-78. The only acanthocephalan species found was *Metechinorhynchus salmonis* (Müller 1780), the total number of which was 1295. The whitefish is shown to be highly susceptible infection by *M. salmonis*, with as many as 88.9% of specimens infected in a sample in June 1978, although the mean intensity was only 8.9 parasites per host. The river-spawning whitefish does not favour the intermediate host, *Pontoporeia affinis*, in its summer diet in the Bothnian Bay preferring to feed on eggs and molluscs, so that the incidence of *M. salmonis* infection decreases to 33.3% by the middle of summer. This is further reduced in the late summer by the fast associated with the migration to their upriver spawning grounds. The fact that the other ancanthocephalan inhabiting the river-spawning whitefish in the southern Gulf of Bothnia, *Echinorhynchus gadi* Müller, 1776 is not to be found in the Bothnian Bay population suggests that the fish captured in spring have remained in the bothnian Bay throughout the winter.

OTHER DISEASES AND PARASITES (CONTINUED)

81-000785 van Banning, P. THE OCCURRENCE OF BLACK SPOTS IN THE TONGUE SOLE, *CYNOGLOSSUS BROWNI* CHABANAUD, DUE TO NEMATODE EGGS (*CAPILLARIA SPINOSA*) PREVIOUSLY DESCRIBED IN THE SHARK *CARCHARHINUS MILBERTI* MÜLLER & HENLE. *J. Fish Biol.* 17(3):305-309. Sept. 1980. SFA 26(1)
[Neth. Inst. Fish. Invest., Haringkade 1, 1970 AB Ijmuiden, Netherlands] The occurrence of black spots in fillets of the tongue sole, *Cynoglossus browni*, due to the occurrence of nematode eggs is reported. The eggs were found to be identical with *Capillaria spinosa* egg type previously described from the shark, *Carcharhinus milberti*. The presence of the capillarid eggs in the tongue sole is discussed as a new observation in relation to gaps in knowledge of the adult nematode and the biology of the shark.

81-000786 Weitkamp, D. E. and M. Katz. A REVIEW OF DISSOLVED GAS SUPERSATURATION LITERATURE. *Trans. Am. Fish. Soc.* 109(6):659-702. Nov. 1980. SFA 26(1)
[Parametrix, Inc., 13020 Northup Way, Suite 8, Bellevue, WA 98005]

POLLUTION

81-000787 Alcorn, D. J.; L. E. Fancher and J. G. Moss. HARBOR SEAL AND FISH POPULATIONS--BEFORE AND AFTER A SEWAGE SPILL IN SOUTH SAN FRANCISCO BAY. *Calif. Fish Game* 66(4):238-240. Oct. 1980. SFA 26(1)
[U.S. FWS, San Francisco Bay Natl. Wildl. Refuge, P.O. Box 524, Newark, CA 94560]

81-000788 Bergheim, A. and A. Sivertsen. OXYGEN CONSUMING PROPERTIES OF EFFLUENTS FROM FISH FARMS. *Aquaculture* 22(1-2):185-187. Jan. 1981. SFA 26(1)
[Dir. Wildl. Freshwater Fish., 1432 Ås-NLH, Norway] Chemical and biochemical oxygen demands were measured in the feeds used and in the inlet-outlet water at some freshwater trout farms. The oxygen consuming potential of 1 kg feed corresponded to 5-10 population equivalents. The biochemical oxidation rate during 10 days of the "net loading" (BOD outlet-BOD inlet) was equal to that of sewage. Characterizing the organic loadings from fish farms in terms of population equivalents therefore seems proper. The regression of COD on BOD_7 was also calculated.

81-000789 Bjerk, J. E. and E. M. Brevik. ORGANOCHLORINE COMPOUNDS IN AQUATIC ENVIRONMENTS. *Arch. Environ. Contam. Toxicol.* 9(6):743-750. 1980. SFA 26(1)
[Dir. Labour Inspection, P.O. Box 8103, Dep., Oslo 1, Norway]

81-000790 Chvojka, R. and R. J. Williams. MERCURY LEVELS IN SIX SPECIES OF AUSTRALIAN COMMERCIAL FISH. *Aust. J. Mar. Freshwater Res.* 31(4):469-473. Sept. 1980. SFA 26(1)
[N.S.W. State Fish., 211 Kent St., Sydney, N.S.W. 2000, Australia]

81-000791 El Zorgani, G. A. RESIDUES OF ORGANOCHLORINE PESTICIDES IN FISHES IN SUDAN. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes (Marcel Dekker, Inc., N.Y.)* 15(6):1091-1098. SFA 26(1)
[Agric. Res. Corp., Wad Medini, Sudan]

POLLUTION (CONTINUED)

81-000792 Eriksson, M. O. G.; L. Henrikson; B.-I. Nilsson; G. Nyman; H. G. Oscarson; A. E. Stenson and K. Larsson. PREDATOR-PREY RELATIONS IMPORTANT FOR THE BIOTIC CHANGES IN ACIDIFIED LAKES. *Ambio* 9(5):248-249. 1980. SFA 26(1)
[Dep. Zool., Univ. Gothenburg, Box 25059, S-400 31 Gothenburg, Sweden]

81-000793 Fritz, E. S. POTENTIAL IMPACTS OF LOW PH ON FISH AND FISH POPULATIONS. AIR POLLUTION AND ACID RAIN. *U.S. Fish Wildl. Serv.* FWS/OBS-80-40.2. iii + 14p. Oct. 1980. SFA 26(1)
[U.S. FWS, Natl. Power Plant Team, 2929 Plymouth Rd., Room 206, Ann Arbor, MI 48105] Descriptions of the effects of low pH on fish are presented. Subject areas are identified in which further studies are needed. Laboratory experiments show that the toxic effect of low pH differs among species, populations, and age-groups of the same species. Field studies show that the toxicity of low pH is compounded by other water characteristics. Evidence from a number of laboratory and field studies indicate that low pH could increase susceptibility to disease, impair osmoregulation and ionregulation, inhibit hormore production or activity, result in genetic damage, change predator-prey relationships, degrade habitat, and increase the availability of toxic substances. Low pH is shown to result in reproductive failure on the population level, recruitment failure, and on the individual level, cessation of spawning. Slight declines in productivity as they relate to stressed populations, are shown to have the potential to result in unrecoverable drops in population density.

81-000794 Hall, R. J.; G. E. Likens; S. B. Fiance and G. R. Hendrey. EXPERIMENTAL ACIDIFICATION OF A STREAM IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE. *Ecology* 61(4):976-989. Aug. 1980. SFA 26(1)
[Sect. Ecol. Syst., Div. Biol. Sci., Cornell Univ., Ithaca, NY 14850]

81-000795 Haynes, R. J. FUTURE LIGNITE MINING IN THE SOUTH AND IMPACTS ON FISH AND WILDLIFE UNDER SMCRA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:753-764. 1979(1980). SFA 26(1)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

81-000796 Horstman, L. P. CURRENT PESTICIDE USE IN ALBERTA: FISH AND WILDLIFE CONCERNS AND RECOMMENDATIONS. *Alberta Recreation Parks Wildl. Fish Wildl. Div. Wildl. Br.* 149p. 21 Dec. 1976. SFA 26(1)

81-000797 Hose, J. E. and R. J. Stoffel. AVOIDANCE RESPONSE OF JUVENILE *CHROMIS PUNCTIPINNIS* TO CHLORINATED SEAWATER. *Bull. Environ. Contam. Toxicol.* 25(6):929-935. Dec. 1980. SFA 26(1)
[Occidental Coll., Dep. Biol., 1600 Campus Rd., Los Angeles, CA 90014]

81-000798 Jeffree, R. A. and N. J. Williams. MINING POLLUTION AND THE DIET OF THE PURPLE-STRIPED GUDGEON *MOGURNDA MOGURNDA* RICHARDSON (ELEOTRIDAE) IN THE FINNISS RIVER, NORTHERN TERRITORY, AUSTRALIA. *Ecol. Monogr.* 50(4):457-485. Dec. 1980. SFA 26(1)
[N.J. Williams: Aust. Atomic Energy Comm. Res. Establ., New Illawarra Rd., Lucas Heights, N.S.W. 2234, Australia]

81-000799 Johnson, B. T. LABORATORY PROCEDURE FOR ESTIMATING RESIDUE DYNAMICS OF XENOBIOTIC CONTAMINANTS IN A FRESHWATER FOOD CHAIN. *U.S. Fish Wildl. Serv. Tech. Pap.* 103. 16p. 1980. SFA 26(1)
[U.S. FWS, Columbia Natl. Fish. Res. Lab., Rt. 1, Columbia, MO 65201] A laboratory method of measuring the accumulation, transfer, elimination, and degradation of xenobiotic contaminants is described for organisms in a

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81-000799 CONTINUED freshwater food chain (microorganisms, filter-feeder, and fish). A flow-through diluter-system, ^{14}C-labeled contaminants, gas and thinlayer chromatography, autoradiography, and liquid scintillation spectrometry are used in making residue determinations. Accumulation factors and various index values are developed for measuring and estimating potential accumulation of xenobiotic contaminants by aquatic organisms. The laboratory procedure is economical, simple, reproducible, and ecologically relevant.

81-000800 Kobayashi, R.; K. Shiomi; H. Yamanaka and T. Kikuchi. [DISTRIBUTION OF ARSENIC IN SOME FISHES.] *Bull. Jpn. Soc. Sci. Fish.* 46(10):1265-1268. Oct. 1980. In Japanese with English summ. SFA 26(1)
[Lab. Food Hygienic Chem., Tokyo Univ. Fish., Konan, Minato-ku, Tokyo 108, Japan]

81-000801 McFarlane, G. A. and W. G. Franzin. AN EXAMINATION OF Cd, Cu, AND Hg CONCENTRATIONS IN LIVERS OF NORTHERN PIKE, *ESOX LUCIUS*, AND WHITE SUCKER, *CATOSTOMUS COMMERSONI*, FROM FIVE LAKES NEAR A BASE METAL SMELTER AT FLIN FLON, MANITOBA. *Can. J. Fish. Aquatic Sci.* 37(10):1573-1578. Oct. 1980. In English with French summ. SFA 26(1)
[W. G. Franzin: Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

81-000802 Platts, W. S. and D. A. Andrews. AQUATIC MACROINVERTEBRATES WITHIN THE PHOSPHATE MINING AREA OF EASTERN IDAHO. *U.S. For. Serv. Res. Note* INT-298. 1980. SFA 26(1)
[Intermountain For. Range Exp. Stn., 316 East Myrtle St., Boise, ID 83706]

81-000803 Sadler, K. EFFECT OF THE WARM WATER DISCHARGE FROM A POWER STATION ON FISH POPULATIONS IN THE RIVER TRENT. *J. Appl. Ecol.* 17(2):349-357. Aug. 1980. SFA 26(1)
[Central Electricity Res. Lab., Freshwater Biol. Unit, Ratcliffe-on-Soar Power Stn., Nottingham NG11 0EE, England] A monthly seine netting programme was conducted from October 1977 to September 1978 above and below Castle Donington Power Station, a 600 MW station situated on the River Trent using a mixed cooling system. This station when operating produced an average increase in river temperatures of 7°C (maximum temperature increase 12°C, minimum 4°C). Nine coarse fish species were recorded of which bleak (*Alburnus alburnus* L.), gudgeon (*Gobio gobio* L.) and roach (*Rutilus rutilus* L.) formed over 92% of the overall catch. Fish population densities and species diversity were generally greater downstream from the power station than upstream. Numbers of all species except bleak were less in winter than in summer. This supports the theory of an upstream migration of fish in winter suggested by other workers. At Castle Donington the migration occured in October and September in thermally unaffectd sites, but was delayed until December and January below the power station discharge. The fish redistributed throughout the river in May.

81-000804 Sloterdijk, H. CONCENTRATIONS OF PCB'S, MERCURY AND SOME OTHER METALS IN LATERAL MUSCLE OF NORTHER PIKE, *ESOX LUCIUS* L., IN THE PROVINCE OF Québec. *Proc. Warm Water Workshop Northeast Div. Am. Fish. Soc.* 10:89-115. 1977(1979). SFA 26(1)
[Gest. Environ., Lab. Qual. L'eau, 1001, Pierre Dupuy, Longueuil, PQ J4K 1A1, Canada]

81-000805 Solbakken, J. E. and K. H. Palmork. DISTRIBUTION OF RADIOACTIVITY IN THE CHONDRICHTHYES *SQUALUS ACANTHIAS* AND THE OSTEICHTHYES *SALMO GAIRDNERI* FOLLOWING INTRAGASTRIC ADMINISTRATION OF

POLLUTION (CONTINUED)

81-000805 CONTINUED (9-^{14}C) PHENANTHRENE. *Bull. Environ. Contam. Toxicol.* 25(6):902-908. Dec. 1980. SFA 26(1)
[Inst. Mar. Res., Dir. Fish., Nordnesparken 2, N-5011 Bergen-Nordnes, Norway]

81-000806 Tervo, V.; K. Erkomaa; H. Sandler; V. Miettinen; R. Parmanne and E. Aro. CONTENTS OF METALS AND CHLORINATED HYDROCARBONS IN FISH AND BENTHIC INVERTEBRATES IN THE GULF OF BOTHNIA AND IN THE GULF OF FINLAND IN 1979. *Int. Counc. Explor. Sea* C.M. 1980/E:61. 19p. 1980. SFA 26(1)
[Inst. Mar. Res., P.O. Box 166, SF-00141 Helsinki 14, Finland]

81-000807 Umber, H. A LOOK BACK AT SALMON IN NORTH DAKOTA. *N. D. Outdoors* 43(5):7-8. Nov. 1980. SFA 26(1)

81-000808 Urban Wildlife Research Center Inc. COMPATIBILITY OF FISH, WILDLIFE, AND FLORAL RESOURCES WITH ELECTRIC POWER FACILITIES. xvii + 130p. 1980. Available from Edison Electric Inst., 1111 19th Street, N.W., Washington, DC 20036. SFA 26(1)

81-000809 Van Hassel, J. H.; J. J. Ney and D. L. Garling, Jr. HEAVY METALS IN A STREAM ECOSYSTEM AT SITES NEAR HIGHWAYS. *Trans. Am. Fish. Soc.* 109(6):636-643. Nov. 1980. SFA 26(1)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg 24061]

FISH KILLS

81-000810 Das, S. M. and J. Pande. STUDIES ON ANNUAL WINTER FISH MORTALITY IN LAKE NAINITAL. *Indian J. Anim. Sci.* 50(7):561-564. 1980. SFA 26(1)
[Kumaon Univ., Nainital, Uttar Pradesh 263 001, India] Mass fish mortality occurs every winter for the last few years in Nainital Lake. The sequence of events in fish kill was recorded as *Anacystis* bloom→death of plankton→high SOM (suspended organic matter)→depletion of oxygen, high CO_2 and ammonia→fish-kill. The maximum mortality was *Puntius ticto, P. conchonius* and *P. sophore*, and juveniles of *Cyprinus carpio* and *Schizothorax richardsoni*.

81-000811 Hayne, D. W.; R. D. Ober; L. E. Schaaf and D. G. Scott. BARKLEY LAKE SYMPOSIUM. COMPARISON OF SECOND-DAY PICKUP WITH NUMBERS ESTIMATED BY POLLUTION COMMITTEE COUNTING GUIDELINES--BARKLEY LAKE STUDY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:738-752. 1979(1980). SFA 26(1)
[Southeast. Fish Game Stat. Proj., N.C. State Univ., Raleigh 27067] Methods proposed in Pollution Committee Guidelines for estimating numbers and values of dead fish in open water are practical under field trial.

TOXICOLOGY; BIOASSAYS

81-000812 Arillo, A.; R. Mantovani; C. Margiocco; F. Melodia and P. Mensi. EFFECTS OF EXPOSURE TO HIGH ENVIRONMENTAL pH AND TO SUBLETHAL AMMONIA CONCENTRATIONS ON LIVER CARBOHYDRATES IN *SALMO GAIRDNERI*. *Mem. Ist. Ital.*

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000812 CONTINUED *Idrobiol. Dott. Marco Marchi.* 37:51-61. 1979. SFA 26(1)
[Inst. Zool., Univ. Genova, Italy]

81-000813 Bath, R. N. and F. B. Eddy. TRANSPORT OF NITRITE ACROSS FISH GILLS. *J. Exp. Zool.* 214(1):119-121. Oct. 1980. SFA 26(1)
[Dep. Biol. Sci., The University, Dundee DD1 4HN, Scotland]

81-000814 Blanco, O. and T. Meade. EFFECT OF DIETARY ASCORBIC ACID ON THE SUSCEPTIBILITY OF STEELHEAD TROUT (*SALMO GAIRDNERI*) TO NITRITE TOXICITY. *Rev. Biol. Trop.* 28(1):91-107. July 1980. In English with Spanish summ. SFA 26(1)
[Univ. Costa Rica, Cent. Univ. Occidente, San Ramón, Costa Rica] Four diets, each containing different levels of ascorbic acid were fed to duplicate groups of steelhead trout (*Salmo gairdneri*) in two four-week periods. Tolerance to nitrites increased when the concentration of ascorbic acid was high. Flow-through bioassays in fingerlings showed that when the temperature increased the percent of methemoglobin in their blood also increased. The tolerance to nitrite toxicity was less in large fish than in those smaller fed the same concentration of ascorbic acid. Possibly ascorbic acid acts in the reduction of methemoglobin to hemoglobin, and also it has a protective effect against stress in the fish. A "safe" level of 200 mg/kg of ascorbic acid in practical diets was reached.

81-000815 Busacker, G. P. OSMOREGULATORY EFFECTS OF ACUTE CADMIUM TOXICITY IN A MODEL TELEOST. *Ph.D. dissertation, Wayne State Univ.* 225p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1269. Oct. 1980. SFA 26(1)

81-000816 Call, D. J.; L. T. Brooke and P.-Y. Lu. UPTAKE, ELIMINATION, AND METABOLISM OF THREE PHENOLS BY FATHEAD MINNOWS. *Arch. Environ. Contam. Toxicol.* 9(6):699-714. 1980. SFA 26(1)
[Cent. Lake Superior Environ. Stud., Univ. Wis., Superior 54880]

81-000817 Das, K. K. and S. K. Banerjee. CADMIUM TOXICITY IN FISHES. *Hydrobiologia* 75(2):117-121. 18 Oct. 1980. SFA 26(1)
[Dep. Biochem., Univ. Coll. Sci., Calcutta - 700 019, India] Cadmium from industrial effluents pollutes sea and river water and hence may effect the fish population therein. The present investigation shows that resistivity is greater in case of air-breathing fishes as compared to non air-breathing fishes with regards to their duration of survival and growth when exposed to a cadmium containing environment. Under sub-acute levels of cadmium exposure, they respond differently so far as the activities of their liver, gill and intestinal lysosomal enzymes are concerned. Though both species show a definite stress condition on cadmium exposure, the two anatomically different fishes respond differently towards carbohydrate metabolism as observed from liver and muscle glycogen content, liver microsomal glucose-6-phosphatase activity and serum glucose level.

81-000818 Farmer, G. J.; T. R. Goff, D. Ashfield and H. S. Samant. SOME EFFECTS OF THE ACIDIFICATION OF ATLANTIC SALMON RIVERS IN NOVA SCOTIA. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 972. viii + 13p. Nov. 1980. SFA 26(1)
[Freshwater Anadromous Div., Resour. Br., Dep. Fish Oceans, Halifax B3J 2S7, Canada] Mortality (19%-38%) of Atlantic salmon parr (*Salmo salar*) cultured at the Mersey Hatchery, Nova Scotia, has annually occurred during the third and fourth weeks after first feeding. The mortalities were attributed to the soft, acidic water of the Mersey River, which supplies the hatchery. Treatment of the hatchery water with calcium carbonate altered its

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000818 CONTINUED chemical characteristics and enhaced the survival of salmon parr. The chemical characteristics of a number of other rivers which empty on the Atlantic side of mainland Nova Scotia were determined and related to their characteristic 25 years earlier and to the presence or absence of salmon populations.

81-000819 Fingerman, S., W. and L. C. Russell. EFFECTS OF THE POLYCHLORINATED BIPHENYL AROCLOR 1242 ON LOCOMOTOR ACTIVITY AND ON THE NEUROTRANSMITTERS DOPAMINE AND NOREPINEPHRINE IN THE BRAIN OF THE GULF KILLFISH, *FUNDULUS GRANDIS*. *Bull. Environ. Contam. Toxicol.* 25(4):682-687. Oct. 1980. SFA 26(1)
[Dep. Biol., Tulane Univ., New Orleans, LA 70118]

81-000820 Finlayson, B. J. ACUTE TOXICITIES OF THE HERBICIDES KOMEEN® AND HYDROTHOL-191® TO GOLDEN SHINER *(NOTEMIGONUS CRYSOLEUCAS)*. *Bull. Environ. Contam. Toxicol.* 25(4):676-681. Oct. 1980. SFA 26(1)
[Calif. Dep. Fish Game, Pestic. Invest. Unit, Water Pollut. Control Lab., 987 Jed Smith Dr.,Sacaramento 95819]

81-000821 Franklin, F. ASSESSING THE TOXICITY OF INDUSTRIAL WASTES, WITH PARTICULAR REFERENCE TO VARIATIONS IN SENSITIVITY TO TEST ANIMALS. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 61. 10p. 1980. SFA 26(1)
[Fish. Lab., Burnham-on-Crouch, England]

81-000822 Freeman, B. J. ACCUMULATION OF CADMIUM, CHROMIUM, AND LEAD BY BLUEGILL SUNFISH (*LEPOMIS MACROCHIRUS* RAFINESQUE) UNDER TEMPERATURE AND OXYGEN STRESS. *Ph.D. dissertation, Univ. Ga.* 137p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(4):1271. Oct. 1980. SFA 26(1)

81-000823 Giam, C. S.; H. E. Murray; L. E. Ray and S. Kira. BIOACCUMULATION OF HEXACHLOROBENZENE IN KILLFISH (*FUNDULUS SIMILIS*). *Bull. Environ. Contam. Toxicol.* 25(6):891-897. Dec. 1980. SFA 26(1)
[Dep. Chem., Tex. A&M Univ., College Station 77843]

81-000824 Gill, S. S. *IN VITRO* METABOLISM OF CARBOFURAN BY LIVER MICROSOMES OF THE PADIFIELD FISH *TRICHOGASTER PECTORALIS*. *Bull. Environ. Contam. Toxicol.* 25(5):697-701. Nov. 1980. SFA 26(1)
[Div. Toxicol. Physiol., Dep. Entomol., Univ. Calif., Riverside 92521]

81-000825 Goodger, W. P. and T. A. Burns. THE CARDIOTOXIC EFFECTS OF ALLIGATOR GAR (*LEPISOSTEUS SPATULA*) ROE ON THE ISOLATED TURTLE HEART. *Toxicon* 18(4):489-494. 1980. SFA 26(1)
[Dep. Biol. Sci., Northwest. State Univ., Natchitoches, LA 71457]

81-000826 Guiney, P. D. and R. E. Peterson. DISTRIBUTION AND ELIMINATION OF A POLYCHLORINATED BIPHENYL AFTER ACUTE DIETARY EXPOSURE IN YELLOW PERCH AND RAINBOW TROUT. *Arch Environ. Contam. Toxicol.* 9(6):667-674. 1980. SFA 26(1)
[R. E. Peterson: 425 North Charter St., Sch. Pharm., Univ. Wis., Madison 53706]

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000827 Hilmy, A. M.; M. B. Shabana and M. M. Saied. BLOOD CHEMISTRY LEVELS AFTER ACUTE AND CHRONIC EXPOSURE TO $HgCl_2$ IN THE KILLFISH *APHANIUS DISPAR* (RUPP). *Water Air Soil Pollut.* 14:409-417. 1980. SFA 26(1)
[Dep. Zool., Fac. Sci., Alexandria Univ., Alexandria, Egypt]

81-000828 Hilmy, A. M.; M. B. Shabana and M. M. Said. HEAMATOLOGICAL RESPONSES TO MERCURY TOXICITY IN THE MARINE TELEOST, *APHANIUS DISPAR* (Rüpp). *Comp. Biochem. Physiol. C Comp. Pharmacol.* 67(2):147-158. 1980. SFA 26(1)
[Dep. Zool., Fac. Sci., Alexandria Univ., Egypt]

81-000829 Hinton, M. J. and A. G. Eversole. TOXICITY AND TOLERANCE STUDIES WITH YELLOW-PHASE EELS: FIVE CHEMICALS. *Prog. Fish-Cult.* 42(4):201-203. Oct. 1980. SFA 26(1)
[U.S. SCS, 219 E. Main St.,Lexington, SC 29072]

81-000830 Hlavek, R. R. and R. V. Bulkley. EFFECT OF MALACHITE GREEN ON LEUCOCYTE ABUNDANCE IN RAINBOW TROUT, *SALMO GAIRDNERI* (RICHARDSON). *J. Fish Biol.* 17(4):431-444. Oct. 1980. SFA 26(1)
[Biol. Dep., Marian Coll., Indianapolis, IN 46222] Blood counts from more than 1000 young-of-the-year rainbow trout, *Salmo gairdneri* (Richardson), were examined to determine if static exposure to malachite green at 1.35, 13.5, or 21.0 mg/l for 25-30 min, or 42.0 or 72.0 mg/l for 5 min caused chronic leucopaenia. The major changes in fish exposed for 25-30 min came during the first 24 h. After an initial lag of 3-4 h, total leucocyte-thrombocyte counts in both treated and control fish rapidly declined. Recovery was essentially complete 1-4 days after exposure, and no leucopaenia was noted after 14 or 28 days. Thrombocytosis developed during the first 24 h in fish exposed to the higher concentrations. Lymphopaenia and neutrophilia also developed, but abated after the 4th post-treatment day. Leucocyte numbers in control and exposed groups were virtually the same by the 14th day. The total leucocyte-thrombocyte counts in fish exposed for 5 min declined after 24 h, but counts were not as depressed as those in fish exposed for 30 min. Because leucocyte changes similar to those in exposed fish were evident in the controls in both experiments, we believe that the leucocyte changes in rainbow trout exposed to malachite green were a result of a nonspecific vertebrate stress syndrome, rather than of specific leucocytotoxic effect of this chemical.

81-000831 Huey, D. W.; B. A. Simco and D. W. Criswell. NITRITE-INDUCED METHEMOGLOBIN FORMATION IN CHANNEL CATFISH. *Trans. Am. Fish. Soc.* 109(5):558-562. Sept. 1980. SFA 26(1)
[Ecol. Res. Cent., Dep. Biol., Memphis State Univ., Memphis, TN 38152]

81-000832 Jackson, W. F. and P. O. Fromm. EFFECT OF ACUTE ACID STRESS ON ISOLATED PERFUSED GILLS OF RAINBOW TROUT. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 67(2):141-145. 1980. SFA 26(1)
[Dep. Physiol., Mich. State Univ., East Lansing 48824]

81-000833 Johnson, W. W. and M. T. Finley. HANDBOOK OF ACUTE TOXICITY OF CHEMICALS TO FISH AND AQUATIC INVERTEBRATES. *U.S. Fish Wildl. Serv. Resour. Publ.* 137. v + 98p. 1980. SFA 26(1)
[Off. Environ., U.S. FWS, P.O. Box 95067, Atlanta, GA 30347]

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000834 Kasuga, S. [SEXUAL DIFFERENCES OF MEDAKA, *ORYZIAS LATIPES* IN THE ACUTE TOXICITY TEST OF CADMIUM.] *Bull. Jpn. Soc. Sci. Fish.* 46(9):1073-1076. Sept. 1980. In Japanese with English summ. SFA 26(1)
[Environ. Biol. Div., Natl. Inst. Environ. Stud., Yatabe, Ibaraki 305, Japan]

81-000835 Kawatsu, H. HEMATOLOGICAL CHARACTERISTICS OF MOLINATE ANEMIA IN COMMON CARP. *Bull. Jpn. Soc. Sci. Fish.* 46(9):1103-1107. Sept. 1980. SFA 26(1)
[Fac. Agric. Miyazaki Univ., 210 Funatsuka-3, Miyazaki 880, Japan]

81-000836 Kinae, N.; T. Hashizume; T. Makita; I. Tomita; I. Kimura and H. Kanamori. STUDIES ON THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS--II. MUTAGENICITY OF THE EXTRACTS OF THE LIVER FROM SPOTTED SEA TROUT (*NIBEA MITSUKURII*). *Water Res.* 15(1):25-30. 1981. SFA 26(1)
[Lab. Health Sci., Shizuoka Coll. Pharm. Sci., Shizuoka 422, Japan]

81-000837 Lee, R. M. and S. D. Gerking. SENSITIVITY OF FISH EGGS TO ACID STRESS. *Water Res.* 14(12):1679-1681. 1980. SFA 26(1)
[Dep. Zool., Ariz. State Univ., Tempe 85281] Craig & Baksi (*Water Res.* 11, 621-626, 1977) may have exaggerated the effect of acid stress on oogenesis by comparing the low viability of eggs laid and incubated at pH 4.5 and 5.0 with the higher survival of eggs laid at pH 6.7 and transfered after 12 h to pH 4.5 and 5.0. On the basis of our findings, a lower survival would have been ovserved in the latter group if the eggs had been transfered immediately to the acid conditions. The egg changes its character rapidly after being laid. Permeability decreases and the chorion hardens during the first few hours after release, allowing the egg to become more resistant with time. The results of two experiments are reported to demonstrate this effect.

81-000838 Markarian, R. K.; M. C. Matthews and L. T. Connor. TOXICITY OF NICKEL, COPPER, ZINC AND ALUMINUM MIXTURES TO THE WHITE SUCKER (*CATOSTOMUS COMMERSONI*). *Bull. Environ. Contam. Toxicol.* 25(5):790-796. Nov. 1980. SFA 26(1)
[Bio-Dynamics, Inc., East Millstone, NJ 08873]

81-000839 McDonald, D. G.; Hobe, H. and C. M. Wood. THE INFLUENCE OF CALCIUM ON THE PHYSIOLOGICAL RESPONSES OF THE RAINBOW TROUT, *SALMO GAIRDNERI*, TO LOW ENVIRONMENTAL pH. *J. Exp. Biol. (Cambridge Univ. Press)* 88:109-131. Oct. 1980. SFA 26(1)
[Dep. Biol., McMaster Univ., Hamilton, ON L8S 4K1, Canada] The physiological responses of 1- to 2-year-old rainbow trout to low pH are dependent on the environmental calcium concentration. Trout, maintained for 5 days in moderately hard water ($[Ca^{2+}]$ = 1.6-2.7 m-equiv/1) at a mean pH of 4.3, developed a major blood acidosis but exhibited only a minor depression in plasma ion levels. In acidified soft water ($[Ca^{2+}]$ = 0.3 m-equiv/1), only a minor acidosis occurred, but plasma ion levels fell and there were substantially greater mortalities. Lethal bioassays performed on fingerling trout over a range of pH levels (3.0-4.8) revealed an important influence of external $[Ca^{2+}]$ on resistance to acid exposure. Terminal physiological measurements on adult fish succumbing to low pH in soft water indicate the singular importance of iono-regulatory failure as the toxic mechanism of action under these circumstances.

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000840 McLeese, D. W.; C. D. Metcalfe and V. Zitko. LETHALITY OF PERMETHRIN, CYPERMETHRIN AND FENVALERATE TO SALMON, LOBSTER AND SHRIMP. *Bull. Environ. Contam. Toxicol.* 25(6):950-955. Dec. 1980. SFA 26(1)
[Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

81-000841 McWilliams, P. G. ACCLIMATION TO AN ACID MEDIUM IN THE BROWN TROUT *SALMO TRUTTA*. *J. Exp. Biol. (Cambridge Univ. Press)* 88:269-280. Oct. 1980. SFA 26(1)
[Dep. Biol. Sci., Univ. Lancaster, Lancaster LA1 4YQ, England] Data are presented which demonstrate acclimation of brown trout (*Salmo trutta*) to an acid medium. Sodium fluxes, transepithelial gill potentials and plasma electrolyte concentrations were measured in brown trout exposed to an acid medium of pH 6.0 for a period of 6 weeks. Sodium loss rates in acid exposed fish are reduced compared to normal fish, and sodium uptake is insensitive to external pH following long-term acid exposure. Changes in gill potential and sodium turnover rate following acid exposure can be accounted for by changes in the relative permeability of the gills to sodium and chloride. In neutral media the permeability ratio $\phi Na+/\phi Cl- = 1.12$ but this falls to 0.76 during acid exposure. The ability to acclimate to acid conditions seems to depend largely on changes in gill permeability to sodium.

81-000842 McWilliams, P. G. EFFECTS OF pH ON SODIUM UPTAKE ON NORWEGIAN BROWN TROUT (*SALMO TRUTTA*) FROM AN ACID RIVER. *J. Exp. Biol. (Cambridge Univ. Press)* 88:259-267. Oct. 1980. SFA 26(1)
[Dep. Biol. Sci., Univ. Lancaster, Lancaster LA1 4YQ, England] Sodium uptake rates were measured in wild and hatchery reared Norwegian brown trout (*Salmo trutta*) exposed to media of a range of pH. Sodium uptake was strongly dependent on external acidity, being reduced in media of low pH. Wild fish from the naturally acid R. Tovdal (S. Norway) were more tolerant of acid media than hatchery reared fish. The effects of increasing external sodium concentrations were strongly influenced by low external pH. The results are discussed with respect to brown trout population decline in certain areas of S. Norway.

81-000843 Milton, P. and R. N. Dixon. FURTHER STUDIES OF THE EFFECTS OF THE ANAESTETIC QUINALDINE ON THE PHYSIOLOGY OF THE INTERTIDAL TELEOST *BLENNIUS PHOLIS*. *J. Mar. Biol. Assoc. U.K.* 60(4):1043-1051. Nov. 1980. SFA 26(1)
[Sch. Environ. Stud., Plymouth Polytech., Drake Circus, Plymouth, England] The oxygen consumption of the intertidal teleost *Blennius pholis* L. has been investigated during and subsequent to quinaldine anaesthesia, using a continuous flow apparatus. Marked reductions in oxygen consumption were noted in high concentrations of quinaldine (10 and 20 ppm), and both entry into anaesthesia and recovery from it were rapid. A period of enhanced oxygen consumption followed anaesthesia, except in the lowest concentration of quinaldine (1 ppm). Experiments conducted over a 4 h period with three different salinities (100%, 30% and 10% sea water) indicated that, under the influence of 10 and 20 ppm quinaldine solutions, the fish more resembled an osmoconformer than an osmoregulator. During anaesthesia, water was lost osmotically in 100% sea water, and gained in the more dilute salinities, although it was possible that some osmotic regulation continued. Physiological measurements indicated that quinaldine is suitable for the capture and marking of fish; for surgical procedures it should be mixed with another anaesthetic, for example MS-222, due to the retention of a response to vibratory stimuli.

81-000844 Miyauchi, M.; M. Takagi and T. Uematsu. STUDIES ON THE TOXICITIES OF CHLORINATED NITROBIPHENYL ETHERS TO FISH-III. REDUCTION OF CLORINATED NITROBIPHENYL ETHERS BY CARP AND RAT INTESTINAL ORGANISMS. *Bull. Jpn. Soc. Sci. Fish.* 46(7):837-844. July 1980. SFA 26(1)
[Lab. Food Hygiene, Fac. Fish. Hokkaido Univ., Hakodate 041, Japan]

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000845 Muramoto, S. DECREASE IN CADMIUM CONCENTRATION IN A CD-CONTAMINATED FISH BY SHORT-TERM EXPOSURE TO EDTA. *Bull. Environ. Contam. Toxicol.* 25(5):828-831. Nov. 1980. SFA 26(1)
[Inst. Agric. Biol. Sci., Okayama Univ., 2-20-1 Chu-o, Kurashiki, 710, Japan]

81-000846 Pfeifer, K. F.; L. J. Weber and R. E. Larson. CARBON TETRACHLORIDE-INDUCED HEPATOTOXIC RESPONSE IN RAINBOW TROUT, *SALMO GAIRDNERI*, AS INFLUENCED BY TWO COMMERCIAL FISH DIETS. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 67(2):91-96. 1980. SFA 26(1)
[Corporate Medical Affairs, Allied Chemical Corp., Morristown, NJ 07960]

81-000847 Randall, J. E. A SURVEY OF CIGUATERA AT ENEWETAK AND BIKINI, MARSHALL ISLANDS, WITH NOTES ON THE SYSTEMATICS AND FOOD HABITS OF CIGUATOXIC FISHES. *NOAA Fish. Bull.* 78(2):201-249. Apr. 1980. SFA 26(1)
[Bernice P. Bishop Mus., Box 19000-A, Honolulu, HI 96819]

81-000848 Stott, G. G.; N. H. McArthur; R. Tarpley; R. F. Sis and V. Jacobs. HISTOPATHOLOGICAL SURVEY OF MALE GONADS OF FISH FROM PETROLEUM PRODUCTION AND CONTROL SITES IN THE GULF OF MEXICO. *J. Fish Biol.* 17(5):593-602. Nov. 1980. SFA 26(1)
[Coll. Vet. Med. Texas A&M Univ., College Station] Testes, collected from 11 species of demersal and platform associated pelagic fishes, were examined microscopically for petroleum induced lesions. The fish were taken from 19 oil and gas production platforms and four control sites from the north-central Gulf of Mexico, during two periods, spring and late summer. The status of the spermatogenic cycle at the time specimens were collected correlated well with the known spawning times for the respective species of fish with one exception. Histopathological evaluation revealed acidophilic granular cells, chromatophores, degeneration and focal leucocytic aggregations as the most prominent and abundant conditions in testes, with with encapsulated cysts, protozoa and helminths being observed only rarely. No evidence of adverse effects on gonadal morphology was found.

81-000849 Sudershan, P. and M. A. Q. Khan. METABOLIC FATE OF [^{14}C] ENDRIN IN BLUEGILL FISH. *Pestic. Biochem. Physiol.* 14(1):5-12. Aug. 1980. SFA 26(1)
[M.A.Q. Khan: Dep. Biol. Sci., Univ. Ill., Chicago Circle, P.O. Box 4348, Chicago 60680]

81-000850 Torrans, E. L. ACUTE TOXICITY OF HYDROGEN SULFIDE TO FISH DURING HARVESTING OPERATIONS ON COMMERCIAL CATFISH FARMS: CAUSE, PREVENTION AND CURE. *Ph.D. dissertation, Univ. Okla.* 134p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(6):1995. Dec. 1980. SFA 26(1)
Mortalities of fish resulting from exposure to hydrogen sulfide on commercial fish farms can be avoided by: reducing dissolved sulfide concentrations in the sediment through pond design; improved feeding practices, and the use of lime in the ponds; landing fish in areas of the ponds with lower sulfide concentrations; treating the water with potassium permanganate during harvesting to oxidize the sulfide in the water; reducing the physical exertion of the fish after sub-lethal exposure to H_2S: and allowing for short-term recovery before transportation.--From abstr.

81-000851 Vuorinen, P. and M.-B. Axell. EFFECTS OF THE WATER SOLUBLE FRACTION OF CRUDE OIL ON HERRING EGGS AND PIKE FRY. *Int. Counc. Explor. Sea* C.M. 1980/E:30. 10p. 1980. SFA 26(1)

TOXICOLOGY; BIOASSAYS (CONTINUED)

81-000851 CONTINUED
[Finnish Game Fish. Res. Inst., P.O. Box 193, SF-00131 Helsinki 13, Finland] In the lowest oil concentration tested (0.6 mg/1), the hatching percentage of herring larvae was 50%, being greater than in the control (32%). The percentage declined as the oil concentration increased, and in the highest oil concentration (36 mg/1) only 3.5% of the eggs hatched. For pike fry, the 96-hour LC50 value was 43 mg/1 and the corresponding LC90 value was 64 mg/1. The growth of pike fry was significantly poorer in the two higher oil concentrations than in the control. In the gills of pike fry exposed to oil, the secondary lamellae were bent and changes were observed in the lamella epithelium. The epithelium of the intestine was also damaged.

81-000852 Woodward, D. F. and W. L. Mauck. TOXICITY OF FIVE FOREST INSECTICIDES TO CUTTHROAT TROUT AND TWO SPECIES OF AQUATIC INVERTEBRATES. *Bull. Environ. Contam. Toxicol.* 25(6):846-853. Dec. 1980. SFA 26(1)
[U.S. FWS, P.O. Box 1089, Jackson, WY 83001]

FISH TOXICANTS

81-000853 Howell, J. H.; J. J. Lech and J. L. Allen. DEVELOPMENT OF SEA LAMPREY (*PETROMYZON MARINUS*) LARVICIDES. *Can. J. Fish. Aquatic Sci.* 37(11):2103-2107. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Hammond Bay Biol. Stn., Millersburg, MI 49759]

81-000854 Meyer, F. P. and R. A. Schnick. POTENTIAL PROBLEMS IN THE REGISTRATION OF SEA LAMPREY (*PETROMYZON MARINUS*) CONTROL AGENTS. *Can. J. Fish. Aquatic Sci.* 37(11):2093-2102. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Natl. Fish. Res. Lab., La Corsse, WI 54601]

RESEARCH AND MANAGEMENT-GENERAL

81-000855 FAO of the UN. ACMRR WORKING PARTY ON THE SCIENTIFIC BASIS OF DETERMINING MANAGEMENT MEASURES. *FAO Fish. Rep.* No. 236. vi + 149p. 1980. SFA 26(1)
[Rome, Italy]

81-000856 Fetterolf, C. M., Jr. WHY A GREAT LAKES FISHERY COMMISSION AND WHY A SEA LAMPREY INTERNATIONAL SYMPOSIUM. *Can. J. Fish. Aquatic Sci.* 37(11):1588-1593. Nov. 1980. In English with French summ. SFA 26(1)
[Great Lakes Fish. Comm., Ann Arbor, MI 48105]

81-000857 Oatis, P. H. and J. G. Lindenberg. THE ROLE OF NORTHERN PIKE IN MASSACHUSETTS INLAND SPORTFISHERIES. *Proc. Warm Water Workshop Northeast Div. Am. Fish Soc.* 10:195-200. 1977(1979). SFA 26(1)
[Mass. Div. Fish Wildl., Boston]

81-000858 Smith, B. R. INTRODUCTION TO THE PROCEEDINGS OF THE 1979 SEA LAMPREY INTERNATIONAL SYMPOSIUM (SLIS). *Can. J. Fish Aquatic Sci.* 37(11):1585-1587. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Centrol Stn., Marquette, MI 49855]

RESEARCH AND MANAGEMENT-GENERAL (CONTINUED)

81-000859 Tuunainen, P.; E. Ikonene and H. Auvinen. LAMPREYS AND LAMPREY FISHERIES IN FINLAND. *Can. J. Fish. Aquatic Sci.* 37(11):1953-1959. Nov. 1980. In English with French summ. SFA 26(1)
[Finnish Game Fish. Res. Inst., P.O. Box 193, SF-00131 Helinki 13, Finland]

81-000860 Wolf, K. S. F. SNIESZKO. *J. Fish Dis.* 3(6):451-453. Nov. 1980. SFA 26(1)

REPORTS OF FISHERY STATIONS, STATES, ETC.

81-000861 British Columbia Ministry of Environment. MINISTRY OF ENVIRONMENT ANNUAL REPORT 1979. *B.C. Minist. Environ.* 134p. 1980. SFA 26(1)
[Victoria, BC, Canada]

HABITAT ALTERATIONS

81-000862 Allen, K. O. and J. W. Hardy. IMPACTS OF NAVIGATIONAL DREDGING ON FISH AND WILDLIFE: A LITERATURE REVIEW. *U.S. Fish Wildl. Serv.* FWS/OBS-80/07. vii + 81p. Sept. 1980. SFA 26(1)
[U.S. FWS, U.S. Dep. Interior, Washington, DC 20240]

81-000863 Barclay, J. S. IMPACT OF STREAM ALTERATIONS ON RIPARIAN COMMUNITIES IN SOUTHCENTRAL OKLAHOMA. *U.S. Fish Wildl. Serv.* FWS/OBS-80/17. xiv + 91p. Aug. 1980. SFA 26(1)
[Dep. Ecol. Fish. Wildl., Okla. State Univ., Stillwater 74074]

81-000864 Burgess, S. A. and J. R. Bider. EFFECTS OF STREAM HABITAT IMPROVEMENTS ON INVERTEBRATES, TROUT POPULATIONS, AND MINK ACTIVITY. *J. Wildl. Manage.* 44(4):871-880. Oct. 1980. SFA 26(1)
[Dep. Renew. Resour., Macdonald Campus McGill Univ., Ste. Anne de Bellevue, PQ H9X 1C0, Canada] Two years of data were studied to determine the effect of increasing the brook trout (*Salvelinus fontinalis*) biomass in a section of stream on mink (*Mustela vison*) activity in the area. The study area consisted of 2 homogeneous sections of stream, one of which served as a control. The other section was improved by physically altering stream habitat. Habitat improvement resulted in trout population and biomass increases of 208% and 179%, respectively, after 2 years. Crayfish (*Cambarus bartoni*) biomass was 22% greater in the improved section. Mink activity, as determined by a modified sand-transect technique, averaged 52.5% higher in the area surrounding the improved section. However, mink did not respond to the trout biomass increases, nor was mink activity correlated with the activity patterns of any terrestrial prey species. Analysis of mink scats revealed that trout was not an important prey species, whereas crayfish occurred in 20% of all scats found, and in 50% of those from the study area. Thus, habitat improvement and the resulting increases in crayfish production resulted in greater use of that area by mink, but the trout biomass, which increased due to greater available space, mean section depth, and available cover, did not appear to be exploited by the local mink population.

81-000865 Clady, M. D.; R. C. Summerfelt and R. Tafanelli. FLOATING TIRE BREAKWATERS AND ECOLOGY OF COVES IN AN OKLAHOMA RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:495-506. 1979(1980).

HABITAT ALTERATIONS (CONTINUED)

81-000865 CONTINUED SFA 26(1)
[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater 74074]

81-000866 Coad, B. W. ENVIRONMENTAL CHANGE AND ITS IMPACT ON THE FRESHWATER FISHES OF IRAN. *Biol. Conserv.* 19(1):51-80. Nov. 1980. SFA 26(1)
[Ichthyol. Sect., Natl. Mus. Nat. Sci., Ottawa, ON K1A 0M8, Canada]

81-000867 De Groot, S. J. THE CONSEQUENCES OF MARINE GRAVEL EXTRACTION ON THE SPAWNING OF HERRING, *CLUPEA HARENGUS* LINNÉ. *J. Fish Biol.* 16(6):605-611. June 1980. SFA 26(1)
[Neth. Inst. Fish. Invest., IJmuiden, The Netherlands] The rapid increase of the mining for marine gravels in the North Sea offers a serious threat to the marine environment and especially for the herring populations of the southern North Sea and Channel. The paper reviews the literature dealing with the herring and its spawning ground, behaviour, abiological characteristics -type of substrate, depth, salinity, temperature and current velocity. A hypothesis is made that sound may play an important role in guiding the herring to its spawning site.

81-000868 Lorio, W. J.; M. R. Capezza and O.H. Dakin. AQUATIC ECOLOGICAL PARAMETERS ASSOCIATED WITH SALT MARSH MOSQUITO DITCH SYSTEMS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:484-494. 1979(1980). SFA 26(1)
[Miss. State Univ. Res. Cent., NSTL Station 39529]

81-000869 Pierce, B. E. and G. R. Hooper. BARKLEY LAKE SYMPOSIUM. FISH STANDING CROP COMPARISONS OF TIRE AND BRUSH FISH ATTRACTORS IN BARKLEY LAKE, KENTUCKY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:688-691. 1979(1980). SFA 26(1)
[W. Va. Dep. Nat. Resour., Gassaway 26624] Tire and brush fish attractors were sampled during the Barkley Lake Rotenone Study. Standing crop comparisons were made between tire and brush attractors and control areas. Channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and white crappie (*Pomoxis annularis*) were effectively concentrated by both types of attractors, although brush exceeded tires in concentrating all 4 species. Fish attractors were particularly effective in concentrating harvestable-sized fish.

81-000870 Stern, D. H. and M. S. Stern. EFFECTS OF BANK STABILIZATION ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: A SYNTHESIS. *U.S. Fish Wildl. Serv.* FWS/OBS-80/11. IX + 43p. July 1980. SFA 26(1)
[Dep. Biol., Univ. Mo., Kansas City 64110]

81-000871 Stern, D. H. and M. S. Stern. EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: AN ANNOTATED BIBLIOGRAPHY. *U.S. Fish Wildl. Serv.* FWS/OBS-80/12. vii + 78p. July 1980. SFA 26(1)
[Dep. Biol., Univ. Mo., Kansas City 64110]

HABITAT ALTERATIONS (CONTINUED)

81-000872 Walch, L. A. MOVEMENTS OF LAKE TROUT IN TWIN LAKES, COLORADO, IN RELATION TO THE MT. ELBERT PUMPED-STORAGE POWERPLANT. *U.S. Dep. Interior Water Power Resour. Serv.* REC-ERC-79-17. v + 71p. July 1980. SFA 26(1)
[Colo. Coop. Fish. Res. Unit, Colo. State Univ., Fort Collins 80523] Mean movement rate of 34 lake trout (*Salvelinus namaycush*) tagged with ultrasonic transmitters in Twin Lakes, Colorado, ranged from 1.1 m/min in the fall to 1.6 m/min in the summer. Movement rates between 0830 and 1130 were significantly higher than between 2230 and 0500 during spring, summer, and fall. During the fall, afternoon movements were significantly greater than night movements. Home range sizes of lake trout were larger during the spring, summer, and fall than during the winter. Of the home ranges observed, at least 40% were found in the proximity of the tailrace at all times of the year. More excursions out of home ranges occurred during the spring and fall than during the summer and winter. Gill netting data indicated that lake trout were more likely to be found near the tailrace during spring and fall than during summer or winter. During the summer, lake trout were found to prefer deep areas of the lower lake. Between July and October, they occupied depths where water temperatures in the lower and upper lakes averaged 10.5 and 8.5°C, respectively. Few excursions into water warmer than 12°C occurred. Most lake trout were found within 3 m of the bottom. Movements of fish to within 15 m of shore occurred in all seasons and usually took place between 0600 and 1300. Ripe lake trout were captured at depths ranging from 1.5 to 12 m, but were not captured near the powerplant. It is likely that the lake trout of Twin Lakes will be least vulnerable to entrainment by pumping operations between 2230 and 0500 and most vulnerable between 0830 and 1130 during spring, summer, and fall. Seasonally, they will be least vulnerable in the winter and most vulnerable in the spring.

81-000873 Wydoski, R. S. and W. T. Helm. EFFECTS OF ALTERATIONS TO LOW GRADIENT REACHES OF UTAH STREAMS. *U.S. Fish Wildl. Serv.* FWS/OBS-80/14. xviii + 160p. Apr. 1980. SFA 26(1)
[U.S. FWS, Natl. Fish. Cent., Kearneysville, WV 25430]

81-000874 Wydoski, R. S. and W. T. Helm. EFFECTS OF ALTERATIONS TO LOW GRADIENT REACHES OF UTAH STREAMS: SUMMARY. *U.S. Fish. Wildl. Serv.* FWS/OBS-80/13. v + 13p. Apr. 1980. SFA 26(1)
[U.S. FWS, Natl. Fish. Cent., Kearneysville, WV 25430]

81-000875 Young, R. D. and O. E. Maughan. DOWNSTREAM CHANGES IN FISH SPECIES COMPOSITION AFTER CONSTRUCTION OF A HEADWATER RESERVOIR. *Va. J. Sci.* 31(3):39-41. 1980. SFA 26(1)
[Okla. Coop. Fish. Res. Unit, Stillwater 74074] Loss of cold water habitat resulting from reservoir construction resulted in the elimination of *Salvelinus fontinalis* (brook trout) and *Rhinichthys atratulus* (blacknose dace) from downstream areas of John's Creek, Virginia and was probably responsible for the absence of *Chrosomus oreas* and the reduction in numbers of *Cottus bairdi* downstream from the reservoir. Shallowness of the reservoir appeared to cause the higher downstream temperatures. The collective impact of improperly constructed impoundments in montane areas could result in significant losses of cold water habitats and associated species.

HARVEST, CREEL CENSUS, ETC.

81-000876 Ditton, R. B.; A. R. Graefe and A. J. Fedler. PREDICTING MARINE RECREATIONAL FISHING PATTERNS FROM BOAT CHARACTERISTICS AND EQUIPMENT. *Trans. Am. Fish. Soc.* 109(6):644-648. Nov. 1980. SFA 26(1)
[Dep. Recreation Parks, Tex. A&M Univ., College Station 77843]

HARVEST, CREEL CENSUS, ETC. (CONTINUED)

81-000877 Marais, J. F. K. and D. Baird. ANALYSIS OF ANGLERS' CATCH DATA FROM THE SWARTKOPS ESTUARY. *S. Afr. J. Zool.* 15(2):61-65. 1980. In English with Afrikaans summ. SFA 26(1)
[Dep. Zool., Univ. Port Elizabeth, P.O. Box 1600, Port Elizabeth, 6000, South Africa]

81-000878 Mauck, P. E. BLUE RIVER TROUT CREEL SURVEY RESULTS, 1970-76. *Proc. Okla. Acad. Sci.* 60:100-101. 1980. SFA 26(1)
[Okla. Dep. Wildl. Conserv., Oklahoma City 73105]

81-000879 Moore, C. J. SOUTH CAROLINA'S NONCOMMERCIAL GILL-NET FISHERY. *Trans. Am. Fish. Soc.* 109(5):577-580. Sept. 1980. SFA 26(1)
[S.C. Wildl. Mar. Resour. Dep., P.O. Box 12559, Charleston 29412]

81-000880 Smith, J. E. CATCH AND EFFORT STATISTICS OF THE CANADIAN GROUNDFISH FISHERY ON THE PACIFIC COAST IN 1979. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 961. iv + 90p. Sept. 1980. In English with French summ. SFA 26(1)
[Dep. Fish. Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

81-000881 Smith, J. W. and C. J. Moore. A SOCIO-ECONOMIC SURVEY OF THE THIRD ANNUAL ARTHUR SMITH KING MACKEREL TOURNAMENT. *S.C. Mar. Resour. Cent. Tech. Rep.* No. 46. 11p. Nov. 1980. SFA 26(1)
[S.C. Wildl. Mar. Resour. Dep., Charleston 29412] An estimated 1,844 anglers participated in the Third Annual Arthur Smith King Mackerel Tournament held in Little River, South Carolina on October 11-12, 1979. These anglers spent an estimated $650,000 to fish in this competition and brought an additional 4740 individuals (friends, family members, business associates and other relatives) to the Little River area. These individuals had an additional estimated economic impact to the Little River area of $229,000. Of the 417 anglers interviewed, 49.8% were South Carolina residents, 39.4% were North Carolina residents and 10.8% were residents of one of eleven additional states. A majority of the interviewees (89.7%) reported they traveled to the Little River area specifically to fish in the tournament. Anglers spent an average of 3.8 days in this area with 62% traveling over 100 miles by car to attend the tournament. Most anglers (81%) lodged at home (29.6%), motels (20.2%), hotels (19.3%) or private beach cottages (11.9%). A total of 340 king mackerel, weighing 3,500 lbs. (1588 kg), were weighed-in by 22.7% of the boats registered in the tournament.

REGULATIONS

81-000882 Davies, J. H.; P. J. Wingate and W. R. Bonner. EVALUATION OF THE REMOVAL OF A MINIMUM SIZE LIMIT ON WALLEYE IN GLENVILLE RESERVOIR, NORTH CAROLINA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:518-522. 1979(1980). SFA 26(1)
[N.C. Wildl. Resour. Comm., Sylva 28779] Removal of a 38.1 mm minimum size limit on walleye in Glenville Reservoir, North Carolina did not significantly affect the mean calcuated total length of those fishes at the first 3 annuli. However, a significant increase in calculated total length was determined at the fourth annulus. There were no significant changes in the mean calculated growth increments. Comparisons of net survey data collected before and after removal of the minimum size limit showed no change in the average catch of walleye per net-day. Also, there was no significant change in the mean total

REGULATIONS (CONTINUED)

81-000882 CONTINUED length and the mean age of walleye caught by anglers. The increased exploitation afforded by removal of the minimum size limit had no effect on the annual harvest of walleye and had a positive effect on the growth of older walleye.

81-000883 Mense, J. BASS LENGTHS LIMITS. A SECOND YEAR UPDATE. *Outdoor Okla.* 36(9):28-31. Nov.-Dec. 1980. SFA 26(1)
[1331 Magnolia, Norman, OK 73069]

FISH CONTROL AND REMOVAL

81-000884 Dahl, F. H. and R. B. McDonald. EFFECTS OF CONTROL OF THE SEA LAMPREY (*PETROMYZON MARINUS*) ON MIGRATORY AND RESIDENT FISH POPULATIONS. *Can. J. Fish. Aquatic Sci.* 37(11):1886-1894. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

81-000885 Gilderhus, P. A. and B. G. H. Johnson. EFFECTS OF SEA LAMPREY (*PETROMYZON MARINUS*) CONTROL IN THE GREAT LAKES ON AQUATIC PLANTS, INVERTEBRATES, AND AMPHIBIANS. *Can. J. Fish. Aquatic Sci.* 37(11):1895-1905. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Natl. Fish. Res. Lab., La Crosses, WI 54601]

81-000886 Hanson, L. H. and P. J. Manion. STERILITY METHOD OF PEST CONTROL AND ITS POTENTIAL ROLE IN AN INTEGRATED SEA LAMPREY (*PETROMYZON MARINUS*) CONTROL PROGRAM. *Can. J. Fish. Aquatic Sci.* 37(11):2108-2117. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Hammond Bay Biol. Stn., Millersburg, MI 49759]

81-000887 Heinrich, J. W.; J. G. Weise and B. R. Smith. CHANGES IN BIOLOGICAL CHARACTERISTICS OF THE SEA LAMPREY (*PETROMYZON MARINUS*) AS RELATED TO LAMPREY ABUNDANCE, PREY ABUNDANCE, AND SEA LAMPREY CONTROL. *Can. J. Fish. Aquatic Sci.* 37(11):1861-1871. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

81-000888 Hunn, J. B. and W. D. Youngs. ROLE OF PHYSICAL BARRIERS IN THE CONTROL OF SEA LAMPREY (*PETROMYZON MARINUS*). *Can. J. Fish. Aquatic Sci.* 37(11):2118-2122. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Hammond Bay Biol. Stn., Millersburg, MI 49759]

81-000889 Lamsa, A. K.; C. M. Rovainen; D. P. Kolenosky and L. H. Hanson. SEA LAMPREY (*PETROMYZON MARINUS*) CONTROL--WHERE TO FROM HERE? REPORT OF THE SLIS CONTROL THEORY TASK FORCE. *Can. J. Fish. Aquatic Sci.* 37(11):2175-2192. Nov. 1980. In English with French summ. SFA 26(1)
[Great Lakes Fish. Comm., 1451 Green Rd., Ann Arbor, MI 48105]

81-000890 Libey, G. S. and L. E. Holland. THE USE OF PERIODIC LIGHT APPLICATIONS OF ROTENONE AS A MANAGEMENT TECHNIQUE FOR SMALL IMPOUNDMENTS. *Purdue Univ. Water Resour. Res. Cent. Tech. Rep.* No. 132. ii + 30p. Sept.

FISH CONTROL AND REMOVAL (CONTINUED)

81-000890 CONTINUED 1980. SFA 26(1)
A light (.1 ppm) application of rotenone was administered to two experimental ponds on June 26, 1979 in an effort to reduce larval bluegill survival through direct toxicity and by reduction of the food base (zooplankton) leading to starvation of the larvae. Zooplankton reductions caused by the toxicant could not be distinguished from natural fluctuations observed in the control pond. An average of .1 ppm concentration of rotenone caused noticeable increases in larval bluegill mortality without observed mortality or stress in bass or larger bluegill. A dosage of .07 ppm rotenone was observed to have minimal influence on larval bluegill numbers. An accurate, properly timed, light application of rotenone has potential as a useful and inexpensive (about $3) technique to manage ponds with excessive prey (bluegill) production.

81-000891 Maitland, P. S. ASSESSMENT OF LAMPREY AND FISH STOCKS IN THE GREAT LAKES IN RELATION TO CONTROL OF THE SEA LAMPREY (*PETROMYZON MARINUS*): REPORT FROM THE SLIS ASSESSMENT MEASUREMENTS TASK FORCE. *Can. J. Fish. Aquatic Sci.* 37(11):2197-2201. Nov. 1980. In English with French summ. SFA 26(1)
[Inst. Terrestrial Ecol., 78 Craighall Rd., Edinburgh EH6 4RQ, Scotland]

81-000892 Moore, H. H. and L. P. Schleen. CHANGES IN SPAWNING RUNS OF SEA LAMPREY (*PETROMYZON MARINUS*) IN SELECTED STREAMS OF LAKE SUPERIOR AFTER CHEMICAL CONTROL. *Can. J. Fish Aquatic Sci.* 37(11):1851-1860. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

81-000893 Sawyer, A. J. PROSPECTS FOR INTEGRATED PEST MANAGEMENT OF THE SEA LAMPREY (*PETROMYZON MARINUS*). *Can. J. Fish. Aquatic Sci.* 37(11):2081-2092. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Entomol., Cornell Univ., Ithaca, NY 14853]

81-000894 Schuldt, R. J. and R. Goold. CHANGES IN THE DISTRIBUTION OF NATIVE LAMPREYS IN LAKE SUPERIOR TRIBUTARIES IN RESPONSE TO SEA LAMPREY, (*PETROMYZON MARINUS*) CONTROL, 1953-77. *Can. J. Fish. Aquatic Sci.* 37(11):1872-1855. Nov. 1980. 500 In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

81-000895 Smith, B. R. and J. J. Tibbles. SEA LAMPREY (*PETROMYZON MARINUS*) IN LAKES HURON, MICHIGAN, AND SUPERIOR: HISTORY OF INVASION AND CONTROL, 1936-78. *Can. J. Fish. Aquatic Sci.* 37(11):1780-1801. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

81-000896 Spangler, G. R. and J. J. Collins. RESPONSE OF LAKE WHITEFISH (*COREGONUS CLUPEAFORMIS*) TO THE CONTROL OF SEA LAMPREY (*PETROMYZON MARINUS*) IN LAKE HURON. *Can. J. Fish. Aquatic Sci.* 37(11):2039-2046. Nov. 1980. In English with French summ. SFA 26(1)
[Dep. Entomol. Fish Wildl., Univ. Minn., St. Paul 55108]

81-000897 Talhelm, D. R. and R. C. Bishop. BENEFITS AND COSTS OF SEA LAMPREY (*PETROMYZON MARINUS*) CONTROL IN THE GREAT LAKES: SOME PRELIMINARY RESULTS. *Can. J. Fish. Aquatic Sci.* 37(11):2169-2174. Nov. 1980. In

FISH CONTROL AND REMOVAL (CONTINUED)

81-000897 CONTINUED English with French summ. SFA 26(1)
[Dep. Fish. Wildl., Mich. State Univ., East Lansing 58824]

81-000898 Torblaa, R. L. and R. W. Westman. ECOLOGICAL IMPACTS OF LAMPRICIDE TREATMENTS ON SEA LAMPREY (*PETROMYZON MARINUS*) AMMOCOETES AND METAMORPHOSED INDIVIDUALS. *Can. J. Fish. Aquatic Sci.* 37(11):1835-1850. Nov. 1980. In English with French summ. SFA 26(1)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855]

MARKING AND TAGGING

81-000899 Bidgood, B. F. FIELD SURGICAL PROCEDURE FOR IMPLANTATION OF RADIO TAGS IN FISH. *Alberta Dep. Energy Nat. Resour. Fish. Res. Rep.* No. 20. Mar. 1980. SFA 26(1)

81-000900 Hein, S. and J. Shepard. A PRELIMINARY TAGGING STUDY ON THE RED DRUM (*SCIAENOPS OCELLATA*) IN QUARTER ACRE PONDS. *La. Wildl. Fish. Comm. Tech. Bull.* No. 31. p. 33-39. Aug. 1980. SFA 26(1)
[La. Mar. Res. Lab., Grand Terre Island]

81-000901 Smith, J. R. MAGNETIC DEVICE TO HOLD CODED WIRE TAGS FOR DECODING. *Prog. Fish-Cult.* 42(4):243. Oct. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

STOCKING AND INTRODUCTIONS

81-000902 Bry, E. THE STORY OF CHINOOK SALMON IN NORTH DAKOTA. *N. D. Outdoors.* 43(5):2-5. Nov. 1980. SFA 26(1)

81-000903 Colesante, R. T. and A. Schiavone, Jr. WALLEYE FRY: SHIPPING AND STOCKING MORTALITY. *Prog. Fish-Cult.* 42(4):238-239. Oct. 1980. SFA 26(1)
[N.Y. State Dep. Environ. Conserv., Constania 13044]

81-000904 Ebel, W. J. TRANSPORTATION OF CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*, AND STEELHEAD, *SALMO GAIRDNERI*, SMOLTS IN THE COLUMBIA RIVER AND EFFECTS ON ADULT RETURNS. *NOAA Fish Bull.* 78(2):491-505. Apr. 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. E., Seattle, WA 98112] Chinook salmon, *Oncorhynchus tshawytscha*, and steelhead, *Salmo gairdneri*, were captured at Little Goose Dam in the Snake River during their seaward migration and transported 400 km downstream to the lower Columbia River below Bonneville Dam. Their survival was increased from 1.1 to 15 times as compared with control fish which passed by seven mainstem low-level dams and reservoirs. Variations in survival were mainly dependent on species and environmental conditions in the river during the period fish were transported. The homing ability of the adult fish was not significantly diminished; less than 0.2% of strays occurred among adult returns from groups transported. Transportation did not affect ocean age or size of returning

STOCKING AND INTRODUCTIONS (CONTINUED)

81-000904 CONTINUED adult steelhead, but ocean age of returning adult chinook salmon may have been affected. Steelhead returned to Little Goose Dam at a substantially higher rate (1.4-2.7%) than chinook salmon (0.1-0.8%) from groups transported. The timing of adult returns of both species to Little Goose Dam was not related to the time of capture and downstream release of smolts.

81-000905 Havey, K. A. STOCKING RATE AND THE GROWTH AND YEILD OF LANDLOCKED ATLANTIC SALMON AT LONG POND, MAINE. *Trans. Am. Fish. Soc.* 109(5):502-510. Sept. 1980. SFA 26(1)
[Me. Dep. Inland Fish. Wildl., Bangor 04401]

81-000906 Rosenthal, H. IMPLICATIONS OF TRANSPLANTATIONS TO AQUACULTURE AND ECOSYSTEMS. *Mar. Fish. Rev.* 42(5):1-14. May 1980. SFA 26(1)
[Biol. Anst. Helgoland, Zentr. Hamburg, Palmaille 9, 2000 Hamburg 50, West Germany] Increasing aquaculture activities occur primarily in areas where support and supply for the developing industry are available, e.g., close to main shipping routes and harbors. Because intensive aquaculture operations often provide ideal conditions for initial establishment of exotic species, the chances for transfer of nonindigenous species increase. Diseases have spread rapidly through multiple transfer of major candidate species for aquaculture. An overview is given of important deleterious side effects accompanying transplantation of aquatic organisms. Well-documented examples on general pathways involved in transplantation of harmful and unwanted species are presented. Problems associated with control measures and regulations are discussed.

81-000907 Van Den Avyle, M. J. and B. J. Higginbotham. GROWTH, SURVIVAL AND DISTRIBUTION OF STRIPED BASS STOCKED INTO WATTS BAR RESERVOIR, TENNESSEE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:361-370. 1979(1980). SFA 26(1)
[Tenn. Coop. Fish. Res. Inst., Tenn. Technol. Univ., Cookeville, 38501] Striped bass (*Morone saxatilis*) were collected from Watts Bar Reservoir, Tennessee, in 1977 and 1978 to assess relationships between growth rates, survival, stocking density, and distribution patterns of stocked fingerlings. Survival and average sizes attained at ages 1 and 2 were inversely related to stocking density and directly related to size at stocking. Average lengths of age 3 and older fish were not related to stocking size, and the principal advantage of stocking large fingerlings was improved survival. Fingerlings stocked during June and July 1978 dispersed rapidly but tended to remain within the general area into which they had been introduced. During October and November 1978, electrofishing catch data indicated a preference for sandy shoreline habitats. Site-specific factors, such as the presence of preferred habitats, should be considered to enhance striped bass survival following stocking.

FISHING GEAR AND TECHNIQUES

81-000908 Aggus, L. R.; D. C. Carver; L. L. Olmsted; L. L. Rider and G. L. Summers. BARKLEY LAKE SYMPOSIUM. EVALUATION OF STANDING CROPS OF FISHES IN CROOKED CREEK BAY, BARKLEY LAKE, KENTUCKY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:710-722. 1979(1980). SFA 26(1)
[U.S. FWS, Fayetteville, AR 72701] The technique of sampling fish in coves by the application of rotenone ("cove-sampling") was evaluated in Barkley Lake, Kentucky, 26-28 September 1978. In 85 ha Crooked Creek Bay (which was subdivided into 24 coves and other subareas), 776 kg/ha of fish were recovered; the total adjusted for non-recovery of marked fish was 865 kg/ha.

FISHING GEAR AND TECHNIQUES (CONTINUED)

81-000908 CONTINUED The numbers and biomass of fish in various coves within the Bay did not closely approximate the standing crop in the total area. Most major species of fish were either overrepresented or underrepresented in the cove samples. Larger coves (mean area, 4.9 ha) produced a more representative sample of the 85-ha Bay with respect to species composition, abundance, standing crop and length distribution. Results of the Barkley Lake study and those of a similar study in Douglas Lake, Tennessee, in 1965 indicated that many adjustment factors are required to equate small-cove standing crop estimates to those of a large bay or an entire reservoir.

81-000909 Axon, J. R.; L. Hart and V. Nash. BARKLEY LAKE SYMPOSIUM. RECOVERY OF TAGGED FISH DURING THE CROOKED CREEK BAY ROTENONE STUDY AT BARKLEY LAKE, KENTUCKY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:680-687. 1979(1980). SFA 26(1)
[Ky. Dep. Fish Wildl. Resour., Frankfort 40601] Recovery rates were determined for marked fish released into 10 to 15 cove areas and 2 of 6 open water areas during the cove rotenone study at Crooked Creek Bay, an 85 ha arm of Barkley Lake, Kentucky. Fish were tagged with a Floy FD-68B dart tag and either released back into the same study area or introduced from an outside area. Of 986 fish tagged in the embayment, 89% were recaptured. Seventy-five percent of the marked fish were recovered in 9 cove areas, where marked fish were released back into the same cove section. Only 32% were recovered from a back-cove area in which marked fish were introduced from an open water area. Sixty percent were recovered outside this area, indicating a strong tendency for displaced fish to escape. Percentage escapement of marked fish from the other 9 cove areas was only 16%. Escapement increased in each cove section that was progessively farther from open water. Escapement also decreased as mean depth of coves increased. This relationship, when expressed in a multiple regression, was significant ($P>0.04$). The marking and release of fish taken from within a study cove is recommended versus displacement to achieve a higher percent recovery. Selection of cove areas having a mean depth resembling that of adjacent open water habitat is also suggested to minimize escapement and obtain a more representative sample of the reservoir fish population.

81-000910 Ben-Yami, M., (ed.) TUNA FISHING WITH POLE AND LINE. xii + 150p. 1980. Available from Fishing News Books Ltd., 1 Long Garden Walk, Farnham, Surrey, England. SFA 26(1)
[Fish. Indus. Div., FAO of the UN, Rome, Italy]

81-000911 Bryan, P. G. THE EFFICIENCY OF MOLLIES, *POECILIA MEXICANA*, AS LIVE BAIT FOR POLE-AND-LINE SKIPJACK FISHING: FISHING TRIALS IN THE TROPICAL CENTRAL PACIFIC. *Mar. Fish. Rev.* 42(6):15-24. June 1980. SFA 26(1)
[Off. Mar. Resour., American Samoa Government, Pago Pago, American Samoa 96799]

81-000912 Davis, S. K.; J. L. Congleton and R. W. Tyler. MODIFIED FYKE NET FOR THE CAPTURE AND RETENTION OF SALMON SMOLTS IN LARGE RIVERS. *Prog. Fish-Cult.* 42(4):235-237. Oct. 1980. SFA 26(1)
[U.S. FWS, Bldg. 204, Naval Support Activity, Seattle, WA 98195]

81-000913 Harman, B. J.; D. L. Johnson and L. Greenwald. PHYSIOLOGICAL RESPONSES OF LAKE ERIE FRESHWATER DRUM TO CAPTURE BY COMMERCIAL SHORE SEINE. *Trans. Am. Fish. Soc.* 109(5):544-551. Sept. 1980. SFA 26(1)
[Woolpert Consultants, 2324 Stanley Ave., Dayton, OH 45404]

FISHING GEAR AND TECHNIQUES (CONTINUED)

81-000914 Hein, S. and J. Shepard. SIZE OF SPOTTED SEATROUT (*CYNOSCION NEBULOSUS*) CAPTURED IN THREE TO THREE AND ONE-QUARTER INCH STRETCHED MONOFILAMENT GILL NETS IN SOUTH LOUISIANA. *La. Wildl. Fish. Comm. Tech. Bull.* No. 31. p. 49-54. Aug. 1980. SFA 26(1)
[La. Mar. Res. Lab., Grand Terre Island]

81-000915 Ishida, T. and K. Shimazaki. [ON THE ENTANGLED CATCH OF SOCKEYE AND CHUM SALMON BY THE SMALL MESH GILLNET.] *Bull. Fac. Fish. Hokkaido Univ.* 31(3):239-245. Aug. 1980. In Japanese with English summ. SFA 26(1)

81-000916 Konagaya, T. [A TRIAL METHOD TO TELEMETRY OF THE SETNET FISHING GROUND.] *Bull. Jpn. Soc. Sci. Fish.* 46(8):919-923. Aug. 1980. In Japanese with English summ. SFA 26(1)
[Fac. Fish., Mie Univ., Edobashi, Tsu 514, Japan]

81-000917 Kriete, W. H., Jr. and J. G. Loesch. DESIGN AND RELATIVE EFFICIENCY OF A BOW-MOUNTED PUSHNET FOR SAMPLING JUVENILE PELAGIC FISHES. *Trans. Am. Fish. Soc.* 109(6):649-652. Nov. 1980. SFA 26(1)
[Va. Inst. Mar. Sci., Sch. Mar. Sci., Coll. William & Mary, Gloucester Point 23062]

81-000918 Ogura, M.; T. Arimoto and Y. Inoue. [INFLUENCE OF THE IMMERSION TIME ON THE HOOKING RATE OF A SMALL BOTTOM LONG-LINE IN COASTAL WATERS.] *Bull. Jpn. Soc. Sci. Fish.* 46(8):963-966. Aug. 1980. In Japanese with English summ. SFA 26(1)
[Lab. Fish. Methodol., Tokyo Univ. Fish., 5-7, Konan-4, Minato-ku, Tokyo 108, Japan]

81-000919 Pearcy, W. G. A LARGE, OPENING-CLOSING MIDWATER TRAWL FOR SAMPLING OCEANIC NEKTON, AND COMPARISON OF CATCHES WITH AN ISAACS-KIDD MIDWATER TRAWL. *NOAA Fish. Bull.* 78(2):529-534. Apr. 1980. SFA 26(1)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331]

81-000920 Powles, H. and C. A. Barans. GROUNDFISH MONITORING IN SPONGE-CORAL AREAS OFF THE SOUTHEASTERN UNITED STATES. *Mar. Fish. Rev.* 42(5):21-35. May 1980. SFA 26(1)
[Fish. Oceans Can., C.P. 15500, PQ G1K 7X7, Canada] Standard trawl survey methods alone are inadequate for assessment of "live-bottom" fish populations off the southeast coast of the United States because of rough bottom and low trawl catches of some commercially important species. Other sampling methods (trapping, underwater television, diver observations) were tested to evaluate their effectiveness for MARMAP surveys in areas characterized by sessile invertebrate communities dominated by sponges and soft corals. A mix of techniques appears to be required to achieve MARMAP objectives of assessment of commercially important species and monitoring of the marine ecosystem: Television photography for location of sponge-soft coral areas prior to sampling, trapping for evaluation of species of low vulnerability to trawls (e.g., red porgy, black sea bass), and trawling with a small mesh liner for sampling of the fish community as a whole, including juveniles.

81-000921 Summers, G. L. and J. R. Axon. BARKLEY LAKE SYMPOSIUM. HISTORY AND ORGANIZATION OF THE BARKELY LAKE ROTENONE STUDY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:673-679. 1979(1980). SFA 26(1)
[Okla. Dep. Wildl. Conserv., Norman 73069]

FISHING GEAR AND TECHNIQUES (CONTINUED)

81-000922 Takizawa, K. ON THE FLUCTUATION OF DAILY CATCH IN SHIRASU FISHERY BY THE SMALL DRAG NET ALONG THE COAST OF TOSA BAY. *Bull Jpn. Soc. Sci. Fish.* 46(7):831-835. July 1980. SFA 26(1)
[Dep. Fish., Fac. Agric., Kyoto Univ., Sakyo-ku, Kyoto 606, Japan]

FERTILIZATION OF SOIL AND WATER

81-000923 LeBrasseur, R. J.; C. D. McAllister and T. R. Parsons. ADDITION OF NUTRIENTS TO A LAKE LEADS TO GREATLY INCREASED CATCH OF SALMON. *Environ. Conserv.* 6(3):187-190. 1979. SFA 26(1)
[Pac. Biol. Stn., Nanaimo, BC, Canada]

81-000924 Metzger, R. J. and C. E. Boyd. LIQUID AMMONIUM POLYPHOSPHATE AS A FISH POND FERTILIZER. *Trans. Am. Fish. Soc.* 109(5):563-570. Sept. 1980. SFA 26(1)
[Auburn Univ., Agric. Exp. Stn., Auburn, AL 36830]

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

81-000925 Fritz, E. S. COOLING WATER INTAKE SCREENING DEVICES USED TO REDUCE ENTRAINMENT AND IMPINGEMENT. *U.S. Fish Wildl. Serv.* FWS/OBS-76/20.9. 21p. July 1980. SFA 26(1)
[U.S. FWS, Natl. Power Plant Team, 2929 Plymouth Rd., Room 206, Ann Arbor, MI 48105] Cooling water intake screening devices that Fish and Wildlife Service personnel may be expected to assess are identified and described. The devices included are modified vertical traveling screens, single entrance double-exit screens, horizontal traveling screens, passive intake screens, radial wells, artificial filter beds, and porous dikes. For each device the location, limitations or restrictions, evidence for reducing entrainment and impingement, and major unresolved problems are also discussed.

81-000926 Harmon, J. R. and D. L. Park. EVALUATION OF A BYPASS SYSTEM FOR JUVENILE SALMONIDS AT LITTLE GOOSE DAM. *Mar. Fish. Rev.* 42(6):25-28. June 1980. SFA 26(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] During the spring of 1978, the National Marine Fisheries Service, under contract to the U.S. Army Corps of Engineers, evaluated a new system for bypassing juvenile chinook salmon, *Oncorhynchus tshawytscha*, and steelhead trout, *Salmo gairdneri*, from turbine intakes at Little Goose Dam on the Snake River. The criteria pertaining to orifice size (8-, 10-, or 12-inch diameter); placement (north, south, or both); and lighting (on or off) were examined. Recommendations included: 1) 8- or 10-inch diameter inserts to reduce orifice size (and conserve water) when bypassing chinook salmon and 2) 12-inch diameter lighted orifices in the north and south ends of the upstream walls of the bulkhead slots when bypassing steelhead trout.

81-000927 Hatch, J. T. SEASONAL OCCURRENCE, DISTRIBUTION, AND POWER PLANT ENTRAINMENT OF LARVAL FISHES IN PRESQUE ISLE HARBOR, LAKE SUPERIOR. *In Proc. Fourth Annu. Larval Fish Conf., U.S. Fish Wildl. Serv.* FWS/OBS-80/43. 123-135. Sept. 1980. SFA 26(1)
[Dep. Ecol. Behav. Biol., Univ. Minn., Minneapolis 55455] A study to determine seasonal occurrence, distribution and power plant entrainment of

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC. (CONTINUED)

81-000927 CONTINUED larval fishes in Presque Isle Harbor was conducted from April 1975 through July 1976. Larval fishes were found in the harbor during all months except September, October, and November. Larvae of most taxa appeared only between April and.August, but coregonines and fourhorn sculpin occurred from December to July and December to June, respectively. In 1976, coregonines and fourhorn sculpin reached peak abundance about mid-May, followed by rainbow smelt in late May, lake trout and white sucker in early June, yellow perch in mid-June, burbot in late June, sculpins of the genus *Cottus* in mid-July, and ninespine stickleback in late July. Maximum estimated densities for the five most abundant taxa were (mean, SD): 28.8 ± 9.9 per m^3 for rainbow smelt, 0.313 ± 0.021 for yellow perch, 0.081 ± 0.003 for coregonines, 0.52 ± 0.0 for burbot, and 0.030 ± 0.002 for fourhorn sculpin. Larvae of most taxa exhibited clumped distributions during their respective periods of peak abundance. Only burbot larvae displayed a uniform distribution. Total entrainment from August 1975 through 1976 was estimated at 8.8 x 10^6 larvae (less than 30 mm SL). Rainbow smelt, coregonines, fourhorn sculpin, and lake trout accounted for 92.8%, 3.4%, 1.5%, and 1.2% of this estimate, respectively. Entrainment appeared to be associated with seasonal succession of larvae, behavioral characteristics of larvae, and physical factors such as river discharge, harbor circulation, and wave action.

81-000928 McDonough, T. A. and P. A. Hackney. RELATIONSHIP OF THREADFIN SHAD DENSITY AND SIZE STRUCTURE TO IMPINGEMENT AT A STEAM-ELECTRIC PLANT. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:639-647. 1979(1980). SFA 26(1).
[Div. Water Resour., TVA, Norris, TN 37828]

81-000929 McFarlane, R. W.; R. A. Frietsche and R. D. Miracle. COMMUNITY STRUCTURE AND DIFFERENTIAL IMPINGEMENT OF SAVANNAH RIVER FISHES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:628-638. 1979(1980). SFA 26(1)
[Environ. Eng. Dep., Brown & Root, Inc., P.O. Box 3, Houston, TX 77001] The fish communities of the middle Savannah River and 2 cooling water intake canals connected to the river had equal species richness and were equally diverse. However, the relative abundance of functionally similar species groups differed between the localities. Sunfishes were more dominant in the canal communities. Suckers contributed 55% of the biomass in all 3 communities. Impingement was very low and spread over 32 speices. Three species of clupeids comprized 32% of the total number of fish impinged. The impingement of a number of species was disproportionate to their relative abundance in the intake canals.

MATHEMATICS, STATISTICAL METHODS, AND MODELING

81-000930 Clark, R. D., Jr.; G. R. Alexander and H. Gowing. MATHEMATICAL DESCRIPTION OF TROUT-STREAM FISHERIES. *Trans. Am. Fish. Soc.* 109(6):587-602. Nov. 1980. SFA 26(1)
[Mich. Dep. Nat. Resour., Inst. Fish. Res., Ann Arbor 48109]

81-000931 D'Atellis, C. E. and C. G. D. Gregorio. UN MODELO ESTOCASTICO DE PESQUERIAS. [A STOCHASTIC MODEL OF FISHERIES.] 1(1):54-68. 1979. In Spanish with English summ. SFA 26(1)
[Inst. Argentino Mat., Buenos Aires, Argentina]

MATHEMATICS, STATISTICAL METHODS, AND MODELING (CONTINUED)

81-000932 Durant, D. F.; D. E. Colle and J. V. Shireman. A SAS PROGRAM SUMMARIZING DATA COLLECTED BY ROTENONE SAMPLING. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:408-414. 1979(1980). SFA 26(1)
[Sch. For. Resour. Conserv., Univ. Fla., Gainesville 32611] A SAS program was designed to compile and summarize data collected by rotenone sampling. The program is designed to accept data in a variety of forms, providing a statistical summary of number, weight and percentage composition for all species and also a separate summary for harvestable gamefish and/or forage fish. Options are available to calculate weights for fish collected on second and third day pickups with weight-length relationships established from first day fish for either individual fish or by size groups.

81-000933 Goodyear, C. P. OSCILLATORY BEHAVIOR OF A STRIPED BASS POPULATION MODEL CONTROLLED BY A RICKER FUNCTION. *Trans. Am. Fish. Soc.* 109(5):511-516. Sept. 1980. SFA 26(1)
[U.S. FWS, 2929 Plymouth Rd., Room 206, Ann Arbor, MI 48105]

81-000934 Jensen, K. W. ON THE USE OF A STOCHASTIC MODEL FOR SIMULATING YIELDS FROM A TROUT LAKE. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 41-44. 1979. SFA 26(1)
[Dir. Wildl. Freshwater Fish, N-1430, Ås, Norway]

81-000935 Kontorin, V. V. THE OPTIMUM RELATIONSHIP BETWEEN NATURAL AND ARTIFICIAL REPRODUCTION OF THE LAKE BAIKAL OMUL, *COREGONUS AUTUMNALIS MIGRATORIUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(4):78-85. 1979. SFA 26(1)
[Limnol. Inst., Siberian Dep., USSR Acad. Sci., Irkutsk, USSR] An analysis is made on a mathematical model of different exploitation rates of a fish population with repeat spawning. Fishing regimes of foraging and spawning populations under natural and hatchery conditions are compared, taking populations of the northern Baikal omul, *Coregonus autumnalis migratorius*, as an example. It is shown that with natural reproduction the greatest catches are achieved when the foraging population in the lake is removed. Use of artificial reproduction is promising only if a survival coefficient makes it possible to change over fully to artificial reproduction with simultaneous fishing of the foraging population.

81-000936 Macdonald, P. D. M. and H. D. Smith. MARK-RECAPTURE ESTIMATION OF SALMON SMOLT RUNS. *Biometrics* 36(3):401-417. Sept. 1980. SFA 26(1)
[Dep. Math. Sci., McMaster Univ., Hamilton, ON L8S 4K1, Canada]

81-000937 Mahon, R. ACCURACY OF CATCH-EFFORT METHODS FOR ESTIMATING FISH DENSITY AND BIOMASS IN STREAMS. *Environ. Biol. Fishes* 5(4):343-360. 8 Dec. 1980. SFA 26(1)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

81-000938 Parker, K. A DIRECT METHOD FOR ESTIMATING NORTHERN ANCHOVY, *ENGRAULIS MORDAX*, SPAWNING BIOMASS. *NOAA Fish. Bull.* 78(2):541-544. Apr. 1980. SFA 26(1)
[NMFS, P.O. Box 271, La Jolla, CA 92038]

81-000939 Sandvik, L. ACCURACY AND ROBUSTNESS OF SOME POPULATION ESTIMATES BASED ON MULTIPLE MARKING. WITH SPECIAL REFERENCE TO FRESH-WATER FISH. *Inst. Freshwater Res. Drottningholm Rep.* No. 58. p. 158-165. 1979. SFA 26(1)
[Zool. Mus., Univ. Oslo, Oslo, Norway]

LAKE MANAGEMENT AND RESEARCH

81-000940 Crowder, L. J.; J. J. Magnuson and S. B. Brandt. RESOURCE USE DYNAMICS AND SPECIES INTERACTIONS AMONG EXOTIC AND NATIVE FISHES IN LAKE MICHIGAN. *Am. Zool.* 20(4):813. 1980. Abstract only. SFA 26(1)
[Univ. Wis., Madison] Our recent studies of food and thermal habitat use by fishes in Lake Michigan suggest mechanisms which help explain species interactions among exotic and native fishes. Fish species caught in aimed bottom trawls in Sept. 1977, segregated along temperature gradients. Five species of common fishes showed complementarity in the use of food and thermal habitat. The common native species ate different prey than exotic alewife (*Alosa pseudoharengus*) or rainbow smelt (*Osmerus mordax*). Native species which decline during the invasion of the exotics were likely affected by both predation and competition from exotics. The study was repeated in 1979 following an increase in a native chub (*Coregonus hoyi*). Chubs have altered the thermal habitat distribution of alewife and smelt. Both competition and predation apparently have influenced resource use and species interactions among these fishes in Lake Michigan.

81-000941 Gravel, Y. and J. Dubé. CONSERVATION PLAN FOR NORTHERN PIKE, *ESOX LUCIUS* L., IN LAKE ST. LOUIS, QUÉBEC. *Proc. Warm Water Workshop Northeast Div. Am. Fish Soc.* 10:61-71. 1977(1979). SFA 26(1)
[Minist. Tour., Montreal, PQ, Canada]

81-000942 Lawrie, A. H. and W. MacCallum. ON EVALUATING MEASURES TO REHABILITATE LAKE TROUT (*SALVELINUS NAMAYCUSH*) OF LAKE SUPERIOR. *Can. J. Fish. Aquatic Sci.* 37(11):2057-2062. Nov. 1980. In English with French summ. SFA 26(1)
[Res. Sect., Fish. Br., Ontario Minist. Nat. Resour., P.O. Box 50, Maple, ON L0J 1E0, Canada]

81-000943 Pearce, W. A. GREAT LAKES REPORT FROM NEW YORK. *Fisheries (Bull. Am. Fish. Soc.)* 5(5):9-12. Sept.-Oct. 1980. SFA 26(1)
[Box 316, Cape Vincent, NY 13618]

81-000944 Pearce, W. A.; R. A. Braem; S. M. Dustin and J. J. Tibbles. SEA LAMPREY (*PETROMYZON MARINUS*) IN THE LOWER GREAT LAKES. *Can. J. Fish. Aquatic Sci.* 37(11):1802-1810. Nov. 1980. In English with French summ. SFA 26(1)
[N.Y. State Dep. Environ. Conserv., Cape Vincent 13618]

81-000945 Stewart, R. W. A SYNOPSIS OF NEW JERSEY CHAIN PICKEREL STUDIES. *Proc. Warm Water Workshop Northeast Div. Am. Fish. Soc.* 10:183-193. 1977(1979). SFA 26(1)
[Div. Fish Game Shellfish, Trenton, NJ]

81-000946 Wainio, A. PACIFIC SALMON'S ROLE IN LAKE ONTARIO. *Ontario Fish Wildl. Rev.* 18(4):8-16. 1979. SFA 26(1)

81-000947 Walters, C. J.; G. Spangler; W. J. Christie; P. J. Manion and J. F. Kitchell. A SYNTHESIS OF KNOWNS, UNKNOWNS, AND POLICY RECOMMENDATIONS FROM THE SEA LAMPREY INTERNATIONAL SYMPOSIUM. *Can. J. Fish. Aquatic Sci.* 37(11):2202-2208. Nov. 1980. In English with French summ. SFA 26(1)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

RIVER AND STREAM MANAGEMENT AND RESEARCH

81-000948 Adams, J. N. and R. L. Beschta. GRAVEL BED COMPOSITION IN OREGON COASTAL STREAMS. *Can. J. Fish. Aquatic Sci.* 37(10):1514-1521. Oct. 1980. In English with French summ. SFA 26(1)
[Sch. For., Oreg. State Univ., Corvallis 97331]

81-000949 Gardner, W. M. and R. K. Berg. AN ANALYSIS OF THE INSTREAM FLOW REQUIREMENTS FOR SELECTED FISHES IN THE WILD & SCENIC PORTION OF THE MISSOURI RIVER. *Mont. Dep. Fish Wildl. Parks* iv + 50p. Sept. 1980. SFA 26(1)
[Mont. Dep. Fish Wildl. Parks, Rt. 4, Box 243, Great Falls 39405]

81-000950 Gibson, R. J. and R. G. Whoriskey, Jr. AN EXPERIMENT TO INDUCE ANADROMY IN WILD BROOK TROUT IN A QUÉBEC RIVER ON THE NORTH SHORE OF THE GULF OF ST. LAWRENCE. *Nat. Can. (Que.)* 107(2):101-110. 1980. In English with French summ. SFA 26(1)
[MacLaren Marex, Inc., St. John's, NF A1A 2Y4, Canada] The Matamek River (North Shore of the Gulf of St. Lawrence, Québec) does not have a natural run of anadromous brook trout, due to a falls impassable to this species 0,7 km from the sea. Wild trout were captured above the falls, and below the falls, and transplanted downriver to the estuary between 29 May and 29 July 1978. They were recaptured by various methods between 15 August and 25 September 1978. Nine hundred and thirty-one fish were released, and two hundred and eighty-four were recovered (30.5%). Poorest recovery was with sizes corresponding to age classes 1+ (5.3%), and 4+ (16.5%), and best recovery was with sizes corresponding to 2+ (30.8%) and 3+ (55.4%). A greater percentage of recaptured fish released in May and June gained weight compared to those released in July (69.8% vs 45.5%). Only 63.8% of the recoveries had gained weight and only about 15% appeared to be "sea trout". Those that lost weight or did not change probably remained in fresh water. Amongst the recaptures marine food was found in the stomachs of 12.4% of the 2+, 10.1% of the 3+ and in none of the other groups. The percentage of fish with coloured flesh increased with age. The percentage of fish with developed gonads was less than occurs in the freshwater population.

81-000951 Kennedy, G. J. A. and C. D. Strange. POPULATION CHANGES AFTER TWO YEARS OF SALMON (*SALMO SALAR* L.) STOCKING IN UPLAND TROUT (*SALMO TRUTTA* L.) STREAMS. *J. Fish Biol.* 17(5):577-586. Nov. 1980. SFA 26(1)
[Fish. Res. Lab., Dep. Agric. North. Ireland, Castleroe Rd., Coleraine, Co. Londonderry, Northern Ireland] The survival of salmon stocked in upland trout streams in the presence of salmon parr was found to be only about half the value recorded when trout alone made up the resident stock. Changes in the trout population were also recorded following the two years of salmon stocking, and these suggested that the presence of salmon parr may also influence trout fry survival. The findings are discussed in the context of habitat competition and total stream holding capacity.

81-000952 Klauda, R. J.; M. Gardinier and K. P. Campbell. THE COMMERCIAL FISHERY FOR AMERICAN SHAD IN THE HUDSON RIVER: FISHING EFFORT AND STOCK ABUNDANCE TRENDS. *In Proceedings of a Workshop on American Shad, Univ. Mass., Amherst, 14-16 Dec. 1976.* SFA 26(1)
[Texas Instruments Ecol. Serv., P.O. Box 237, Buchanan, NY 10511] The American shad (*Alosa sapidissima*) has been an important food fish in the Hudson River since colonial days. Intermittent records of the fishery since the late 1800's reveal a period of high production from 1880-1901; the all time record year was 1889 when the reported catch was 4,332,000 pounds. This

RIVER AND STREAM MANAGEMENT AND RESEARCH (CONTINUED)

81-000952 CONTINUED period of high produciton was followed by a period of low catches through the mid 1930's. Continous records since 1931 indicate that shad landings and fishing effort increased to relatively high levels again from 1936-1946. Shad landings and fishery effort then steadily declined through 1975. Yield per effort indices of abundance since 1931 show that the shad population in the Hudson River has oscillated with a periodicity of 14-16 years but in a generally declining trend. A reassessment of the current management program seems appropriate.

81-000953 Tarplee, W. H., Jr. and W. E. Partin. FISH POPULATIONS OF THE NEUSE RIVER IN THE AREA OF A LOW DAM IN THE UPPER COASTAL PLAIN. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:523-534. 1979(1980). SFA 26(1)

[Carolina Power & Light Co., Shearon Harris Energy Environ. Cent., New Hill, NC 27562] Fish populations in the Neuse River, North Carolina, were studied near a steam electric plant which included a low-head dam as part of the installation. The purpose of the study was to describe the fish population of a moderate-sized upper coastal plain river, and to provide insight in to the distribution of fishes relative to the dam. Fish were collected by gill netting, fyke netting, electrofishing, seining, and trawling to examine the various species and sizes of fishes present. Sampling was conducted over a 1-year period to include seasonal changes in the fish population. Fifty-two species of fish were collected including several estuarine forms, although the study area was located at approximately river mile 140. Several species of anadromous fishes were collected, but of these, only American shad were abundant. Little difference was observed in fish populations among sampling stations, and there is evidence that fish negotiate the dam either over the dam during high flow periods or via the fish ladder.

81-000954 Valtonen, T. EUROPEAN RIVER LAMPREY (*LAMPETRA FLUVIATILIS*) FISHING AND LAMPREY POPULATIONS IN SOME RIVERS RUNNING INTO BOTHNIAN BAY, FINLAND. *Can. J. Fish. Aquatic Sci.* 37(11):1967-1973. Nov. 1980. In English with French summ. SFA 26(1)

[Perämeri Res. Stn., Univ. Oulu, Oulu, Finland]

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

81-000955 Clady, M. D. RESULTS OF STOCKING YOUNG LARGEMOUTH AND SPOTTED BASS IN SEVERAL RATIOS IN OKLAHOMA PONDS. *Proc. Okla. Acad. Sci.* 60:18-25. 1980. SFA 26(1)

[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater 74078] Young-of-the-year northern and Florida largemouth bass (*Micropterus salmoides salmoides* and *M. s. floridanus*) and spotted bass (*M. punctulatus*) were stocked in various ratios at a single density in small (mostly 0.1 ha) Oklahoma ponds in each of two years. Samples of the bass were seined periodically and their size (weight) and food were estimated. Survival and standing crops were measured when ponds were drained. Mean weight of bass was generally greatest in polytypic ponds, but standing crops there were lower in one of the years owing to greater mortality. During one of the years, all three basses ate a wider variety of foods when stocked polytypically, although the total amount of food eaten did not vary. Two strain-specific differences appeared to be independent of the stocking combination; (a) survival of Florida largemouth bass was lower than that of northern largemouth bass, and (b) average weight, survival, standing crop, and diversity of diet were lower for spotted bass than for either supspecies

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

81-000955 CONTINUED of largemouth bass. Judging by total standing crops in the ponds, stocking of spotted bass appeared to be most promising for augmenting native populations of northern largemouth bass.

81-000956 Herring, J. FISH POPULATION ESTIMATE METHODS EVALUATED BY A TOTAL DRAWDOWN. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:393-401. 1979(1980). SFA 26(1)

[Miss. Dep. Wildl. Conserv., P.O. Box 451, Jackson 39205] The fish population of Lake Columbia, a 36.42 ha Mississippi impoundment, was estimated by shoreline seining, mark and recapture, rotenone sampling and gill netting. The impoundment was then drained to evaluate results. Shoreline seining provided an excellent estimate of population balance. Mark and recapture of largemouth bass (*Micropterus salmoides*) gave a statistically valid estimate and was the only mehtod to which statistics could be applied. Length-frequency data of bass from rotenone samples were stable and appeared useful, although large bass were underestimated. Rotenone samples gave balance ratios, but standing crop varied greatly. Gill nets captured all major species and provided useful data on species not adequately represented in rotenone samples.

81-000957 Modde, T. STATE STOCKING POLICIES FOR SMALL WARMWATER IMPOUNDMENTS. *Fisheries (Bull. Am. Fish. Soc.)* 5(5):13-17. Sept.-Oct. 1980. SFA 26(1)

[Dep. Wildl. Fish. Sci., S. Dak. State Univ., Brookings 57007] The results of a nationwide survey of state agency warmwater pond stocking policies are reported. As expected, a high degree of variability among recommendations was observed. The greatest similarity in species recommendations was seen in the southeastern states where a combination of the largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and redear sunfish (*L. microlophus*) was employed most often. Although stocking rates for largemouth bass were rather uniform, considerable variation was observed among rates for sunfish. Use of the alternate-year stocking method was recommended by 66.7% of the state agencies utilizing the bass - sunfish combination. Geographical trends in stocking recommendations suggested that although the bass - bluegill combination may be successful in the southern and midlatitudes of the United States, alternative combinations may be preferable in northern latitudes.

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH

81-000958 Benson, N. G. EFFECTS OF POST-IMPOUNDMENT SHORE MODIFICATIONS ON FISH POPULATIONS IN MISSOURI RIVER RESERVOIRS. *U.S. Fish Wildl. Serv. Res. Rep.* 80. 32p. 1980. SFA 26(1)

[U.S. FWS, NASA/SLIDELL Computer Complex, Slidell, LA 70458] In the Missouri River main stem reservoirs in Montana, North Dakota, and South Dakota, hydrodynamic processes have decreased the lengths of shorelines and changed their configuration during the first 20 to 25 years of impoundment. Shale shores of Lakes Fort Peck, Oahe, Sharpe, and Francis Case were rapidly eroded by wave action and water level fluctuation. Banks slumped, embayments filled, and stumps and debris were covered by sediment. Shale shores developed mean slopes of 5-7% in sections of reservoirs with 10- to 25-km fetches and more than 10% in sections with 3- to 7-km fetches. Glacial till tended to armor the shorelines and deter their degradation in all reservoirs. Bank-cutting was particularly severe up to 1973 in the readily erodible Fort Union sediments along Lake Sakakawea. Water level fluctuation retarded the development of stable shores. Some aquatic vegetation developed along shorelines and in shallow sections of reservoirs in which water levels fluctuated little. Substrate suitable for terrestrial vegetation did not

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

81-000958 CONTINUED develop along the shores of fluctuating reservoirs, except where alluvial deposits were present. Physical changes of the shore probably influenced fish abundance and species composition primarily by changing the quality and and quantity of spawning and nursery habitat. Species that appeared to be adversely affected by shore changes required protected embayments or flooded vegetation for reproduction: white crappie, *Pomoxis annularis*; black crappie, *P. nigromaculatus*; yellow perch, *Perca flavescens*; northern pike, *Esox lucius*; bigmouth buffalo, *Ictiobus cyprinellus*; smallmouth buffalo, *I. bubalus*; and carp, *Cyprinus carpio*. Fish that spawn in tributaries or along rocky shores were not greatly influenced by shore changes (although the growth rate of several species was slowed): sauger, *Stizostedion canadense*; channel catfish, *Ictalurus punctatus*; white bass, *Morone chrysops*; goldeye, *Hiodon alosoides*; and river carpsucker, *Carpiodes carpio*. One species, the walleye, *Stizostedion v. vitreum*, appeared to be benefited by the shore changes. Physical changes along shores have not been adequately addressed in reservoir ecological planning. Fish population data collected before reservoir shores have reached a reasonable degree of stability do not provide a reliable estimate of the ultimate species composition in a reservoir.

81-000959 Buchanan, J. P. and E. M. Scott, Jr. LARVAL FISH POPULATIONS DURING THE FIRST THREE YEARS OF IMPOUNDMENT IN NORMANDY RESERVOIR, TENNESSEE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:648-659. 1979(1980). SFA 26(1)
[TVA, Norris, TN 37828]

81-000960 Hill, D. M. CHARACTERISTICS AND DETERMINANTS OF THE FISHERIES RESOURCES OF THREE COLD TAILWATERS IN TENNESSEE. *J. Tenn. Acad. Sci.* 55(4):130-136. Oct. 1980. SFA 26(1)
[TVA, Norris, TN 37828] Comparison of biological, water quality, and physical characteristics of Apalachia, Norris, and Chilhowee tailwaters indicates that the differences between these regulated streams and comparable but unregulated streams are due to a host of interrelated factors. Aquatic insect diversity is most strongly influenced by seasonal oxygen deficits. Fish species composition has been changed by altered temperature regimes and seasonal oxygen deficits. Standing crops of fish and aquatic insects are directly related to water mineral quality, substrate composition, and minimum instantaneous flows. Relatively infertile streams with adequate minimum flows can be as productive as more fertile streams with inadequate minimum flows.

81-000961 Love, W. T. EFFECTS OF A HIGH RAINFALL YEAR ON TROUT HABITAT IN BULL SHOALS RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:331-343. 1979(1980). SFA 26(1)
[Ark. Game Fish Comm., Hot Springs 71901] Main channel measurements of temperature and dissolved oxygen concentration are used to describe trout habitat in Bull Shoals Reservoir during August, September and October for 1963-1965 and 1969-1973. These months were chosen to show selected events preceding the October minimum of potential trout habitat. Watershed inflow to the reservoir, generation releases, and inflow from upstream Table Rock Dam were analyzed to determine correlations among these factors and minimum volume of potential trout habitat remaining in Bull Shoals Reservoir each year prior to recirculation. Rainfall is the governing influence over watershed inflow, Table Rock Dam inflow, and release from Bull Shoals Dam. During 1973, 161.3 cm of rain fell on the watershed compared to an average of 106.7 cm; trout habitat in the hypolimnion of the reservoir was completely lost by mid-October.

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

81-000962 Scott, E. M., Jr. and J. P. Buchanan. LARVAL FISH POPULATIONS IN LITTLE BEAR CREEK RESERVOIR DURING THE FIRST THREE YEARS OF IMPOUNDMENT. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:660-672. 1979(1980). SFA 26(1)
[Div. Water Resour., Fish. Aquatic Ecol. Br., TVA, Norris, TN 37828]

ESTUARY MANAGEMENT AND RESEARCH

81-000963 D'Croz, L. and B. Kwiecinski. CONTRIBUCIÓN DE LOS MANGLARES A LAS PESQUERÍAS DE LA BAHÍA DE PANAMÁ. [CONTRIBUTION OF MANGROVE SWAMPS TO THE BAY OF PANAMA FISHERIES.] *Rev. Biol. Trop.* 28(1):13-29. July 1980. In Spanish with English summ. SFA 26(1)
[Lab. Biol. Mar., Escuela Biol., Univ. Panama, Panama] The expansion of Panama City created the threat of eliminating the Juan Díaz mangrove swamps on the east side of the city. Studies of the fishery and the ecological importance of these swamps show that many commercially important fishes and almost all the species of commercially important shrimp depend on these swamps during the early stages of their life cycles. Estimates of the contribution of the Juan Díaz mangrove swamps to the Panama Bay Fisheries are in the order of a million dollars per year, and their elimination would greatly affect the ecological balance of a large section of the Pacific coast of Panama.

81-000964 Gosselink, J. TIDAL MARSHES--THE BOUNDARY BETWEEN LAND AND OCEAN. *U.S. Fish Wildl. Ser.* FWS/OBS-80/15. 12p. July 1980. Available from Information Transfer Spceialist, Natl. Coastal Ecosyst. Team, U.S. FWS, NASA - Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458. SFA 26(1)

81-000965 Matlock, G. C.; P. L. Johansen and J. P. Breuer. MANAGEMENT OF RED DRUM IN A TEXAS ESTUARY--A CASE STUDY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 33:442-450. 1979(1980). SFA 26(1)
[Coastal Fish. Br., Tex. Parks Wildl. Dep., 4200 Smith School Rd., Austin 78744] In September 1974 the Texas Parks and Wildlife Commission banned the use of plastic baits on trotlines because these baits were thought to be selective for small (<500 mm) red drum (*Sciaenops ocellata*). The size of red drum landed by commercial fishermen before (1972-1974) and after (1974-1978) the ban was compared with the size of fish collected during Texas Parks and Wildlife Department trammel net surveys in order to determine whether the ban had any effect on either the commercial catch or fish availability. Fish landed by commercial fishermen were significantly larger after the ban then before; therefore, it appears that plastic baits are selective for small red drum and that the ban resulted in the desired effect. The larger red drum in the commercial landings as compared with trammel net caught fish may have resulted from such factors as fishing method (hook size and bait type), fishing location and/or culling. The reason for the increase in size of trammel net caught red drum after the ban is not clear but may involve a complex series of effects such as year class success, changes in recreational fishing pressure or general decrease in commercial harvest. While this study does not prove conclusively that the ban on plastic baits altered the size composition of commercially harvested red drum, it does indicate that the desired result was achieved. Studies of the effects of management regulations of fish populations are necessary to evaluate the effectiveness of such regulations.

ESTUARY MANAGEMENT AND RESEARCH (CONTINUED)

81-000966 Whitfield, A. K. FACTORS INFLUENCING THE RECRUITMENT OF JUVENILE FISHES INTO THE MHLANGA ESTUARY. *S. Afr. J. Zool.* 15(3):166-169. 1980. In English with Afrikaans summ. SFA 26(1)
[Inst. Freshwater Stud., P.O. Box 49, Sedgefield 6573, South Africa]

MARINE MANAGEMENT AND RESEARCH

81-000967 Barrett, I. DEVELOPMENT OF A MANAGEMENT REGIME FOR THE EASTERN PACIFIC TUNA FISHERY. *Ph.D. dissertation, Univ. Wash.* 193p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(5):1609. Nov. 1980. SFA 26(1)

81-000968 Crawford, R. J. M. SEASONAL PATTERNS IN SOUTH AFRICA'S WESTERN CAPE PURSE-SEINE FISHERY. *J. Fish Biol.* 16(6):649-664. June 1980. SFA 26(1)
[Dep. Ind., Sea Fish. Br., Private Bag, Sea Point 8060, South Africa] Well-defined, seasonal trends are evident in the availability and distribution of all six contributors of South Africa's Western Cape commercial purse-seine catch. These are related to spawning, influence the deployment of fishing effort and provide legislating authorities with the prospect of achieving long-term management objectives through regulation of the open season or the closure of certain areas to fishing.

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[Dep. Ichthyol. Herpetol., R. Ont. Mus., 100 Queen's Park, Toronto, ON M5S 2C6, Canada] A field-tested method for setting and photographing freshly dead fishes using three different sized aquaria each with a free adjustable glass plate inside was found efficient for processing different sized fishes. A v-shaped frame of aluminum mounted on a tripod carried two flash units. The angle of the V was calculated to eliminate reflection from the walls of the aquaria, and the camera was hand held. The above combination allowed extremely rapid processing of specimens and could be applied to organisms other than fishes. We believe this technique, possibly with minor modifications, will prove effective in many fields of natural science where the size or nature of specimens does not preclude it, and where photographic documentation of large numbers of fresh specimens is desirable.

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[Fish Wildl. Res. Cent., Mo. Dep. Conserv., Columbia 65201] We examined the accuracy and application of sequential sampling to determine structure of fish stocks, using electrofishing data of largemouth bass (*Micropterus salmoides*) as an example. Structure of the stock was categorized with the index of Proportional Stock Density (PSD), which is the percentage of quality-size fish in the stock. Minimum stock and quality sizes for largemouth bass were defined as 20 and 30 cm, respectively. Sequential sampling is based on data evaluation during collection. An average reduction in sample size of 42% is realized when populations are sampled sequentially rather than continuing to an end point (n=100 fish), because sampling ends as soon as a decision is reached. Fish stocks can be categorized based on PSD, i.e. 0 to 39%, 40 to 60%, or 61 to 100%, or a point estimate of PSD with confidence limits can be calculated. The size of the sample needed to reach a conclusion about stock structure is influenced most by the true PSD of the stock and to a lesser extent by the significance level (α) chosen for the estimate.

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Africa: Lake Victoria
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Alabama: West Point Reservoir
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Alaska: Bering Sea
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Alaska: Wood River Lakes
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